HAWAII ADMINISTRATIVE RULES

TITLE 12 DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

SUBTITLE 8

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH

CHAPTER 83

POWERED PLATFORMS

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Historical Note: Chapter 83 of title 12 is based upon chapter 364 of the Hawaii Occupational Safety and Health Standards, Rules and Regulations. [Eff. 7/11/74; am 12/30/76; R 12/6/82]

§12-83-1 Definitions. As used in this chapter:

"ANSI" means American National Standards Institute.

"ANSI A92.2" means ANSI A92.2-1979, Vehicle-Mounted Elevating and Rotating Aerial devices.

"Anemometer" means an instrument for measuring wind velocity.

"Aerial device" means any vehicle-mounted scoping or articulating device, which is used to position personnel.

"Aerial ladder" means an aerial device consisting of a single-section or multi-section extensible ladder.

"Aerial lift" means any vehicle-mounted aerial device used to elevate personnel to job sites above ground level.

"Angulated roping" means a suspension method where the upper point of suspension is inboard from the attachments on the suspended unit, thus causing the suspended unit to bear against the face of the building.

"Articulating boom platform" means any aerial device with two or more hinged boom sections.

"Building face roller" means a rotating cylindrical member designed to ride on the face of the building wall to prevent the platform from abrading the face of the building and to assist in stabilizing the platform.

"Building maintenance" means operations such as window cleaning, caulking, metal polishing, reglazing, and general maintenance on building surfaces.

"Cable" means a conductor, or group of conductors, enclosed in a weatherproof sheath, that may be used to supply electrical power and/or control current for equipment or to provide voice communication circuits.

"Carriage" means a wheeled vehicle used for the horizontal movement and support of other equipment.

"Certification" means a written, signed, and dated statement confirming the performance of a requirement of this section.

"Combination cable" means a cable having both steel structural members capable of supporting the platform, and copper or other electrical conductors insulated from each other and the structural members by nonconductive barriers.

"Competent person" means a person who, because of training and experience, is capable of identifying hazardous or dangerous conditions in powered platform installations and of training employees to identify such conditions.

"Continuous pressure" means the need for constant manual actuation for a control to function.

"Control" means a mechanism used to regulate or guide the operation of the equipment.

"Davit" means a device, used singly or in pairs, for suspending a powered platform from work, storage, and rigging locations on the building being serviced. Unlike outriggers, a davit reacts its operating load into a single roof socket or carriage attachment.

"Equivalent" means alternative designs, materials or methods which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

"Extensible boom platform" means an aerial device (except ladders) with a telescopic or extensible boom.

"Ground rigging" means a method of suspending a working platform starting from a safe surface to a point of suspension above the safe surface.

"Ground rigged davit" means a davit which cannot be used to raise a suspended working platform above the building face being serviced.

"Guide button" means a building face anchor designed to engage a guide track mounted on a platform.

"Guide roller" means a rotating cylindrical member, operating separately or as part of a guide assembly, designed to provide continuous engagement between the platform and the building guides or guideways.

"Guide shoe" means a device attached to the platform designed to provide a sliding contact between the platform and the building guides.

"Hoisting machine" means a device intended to raise and lower a suspended or supported unit.

"Hoist rated load" means the hoist manufacturer's maximum allowable operating load.

"Installation" means all the equipment and all affected parts of a building which are associated with the performance of building maintenance using powered platforms.

"Insulated aerial device" means an aerial device designed for work on energized lines and apparatus.

"Interlock" means a device designed to ensure that operations or motions occur in proper sequence.

"Intermittent stabilization" means a method of platform stabilization in which the angulated suspension wire rope(s) are secured to regularly spaced building anchors.

"Lanyard" means a flexible line of rope, wire rope, or strap which is used to secure the body belt or body harness to a deceleration device, lifeline, or anchorage.

"Lifeline" means a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

"Live load" means the total static weight of workers, tools, parts, and supplies that the equipment is designed to support.

"Mobile unit" means a combination of an aerial device, its vehicle, and related equipment.

"Obstruction detector" means a control that will stop the suspended or supported unit in the direction of travel if an obstruction is encountered, and will allow the unit to move only in a direction away from the obstruction.

"Operating control" means a mechanism regulating or guiding the operation of equipment that ensures a specific operating mode.

"Operating device" means a device actuated manually to activate a control.

"Outrigger" means a device, used singly or in pairs, for suspending a working platform from work, storage, and rigging locations on the building being serviced. Unlike davits, an outrigger reacts its operating moment load as at least two opposing vertical components acting into two or more distinct roof points and/or attachments.

"Platform" means any personnel-carrying device (basket or bucket) which is a component of an aerial device.

"Platform rated load" means the combined weight of workers, tools, equipment, and other material which is permitted to be carried by the working platform at the installation, as stated on the load rating plate.

"Primary brake" means a brake designed to be applied automatically whenever power to the prime mover is interrupted or

discontinued.

"Poured socket" means the method of providing wire rope terminations in which the ends of the rope are held in a tapered socket by means of poured spelter or resins.

"Prime mover" means the source of mechanical power for machine.

"Rated load" means the manufacturer's recommended maximum load.

"Rated strength" means the strength of air rope, as designated by its manufacturer or vendor, based on standard testing procedures or acceptable engineering design practices.

"Rated working load" means the combined static weight of men, materials, and suspended or supported equipment.

"Registered professional engineer" means a person who has been duly and currently registered and licensed by an authority within the United States or its territories to practice the profession of engineering.

"Roof powered platform" means a working platform where the hoist(s) used to raise or lower the platform is located on the roof.

"Roof rigged davit" means a davit used to raise the suspended working platform above the building face being serviced. This type of davit can also be used to raise suspended working platform which has been ground-rigged.

"Rope" means the equipment used to suspend a component of an equipment installation, i.e., wire rope.

"Safe surface" means a horizontal surface intended to be occupied by personnel, which is so protected by a fall protection system that it can be reasonably assured that said occupants will be protected against falls.

"Secondary brake" means a brake designed to arrest the descent of the suspended or supported equipment in the event of an overspeed condition.

"Self powered platform" means a working platform where the hoist(s) used to raise or lower the platform is mounted on the platform.

"Speed reducer" means a positive type speed reducing machine.

"Stability factor" means the ratio of the stabilizing moment to the overturning moment.

"Stabilizer tie" means a flexible line connecting the building anchor and the suspension wire rope supporting the platform.

"Supported equipment" means building maintenance equipment that is held or moved to its working position by means of attachment directly to the building or extensions of the building being maintained.

"Suspended equipment" means building maintenance equipment that is suspended and raised or lowered to its working position by means of ropes or combination cables attached to some anchorage above the equipment.

"Suspended scaffold (swinging scaffold)" means a scaffold

supported on wire or other ropes, used for work on, or for providing access to, vertical sides of structures on temporary basis. Such scaffold is not designed for use on specific structure or group of structures.

"Tail line" means the nonsupporting end of the wire used to suspend the platform.

"Tie-in guides" means the portion of a building that provides continuous positive engagement between the building and a suspended or supported unit during its vertical travel on the face of the building.

"Traction hoist" means a type of hoisting machine that does not accumulate the suspension wire rope on the hoisting drum or sheave, and is designed to raise and lower a suspended load by the application of friction forces between the suspension wire rope and the drum or sheave.

"Transportable outriggers" means outriggers designed to be moved from one work location to another.

"Trolley carriage" means a carriage suspended from an overhead track structure.

"Vehicle" means any carrier that is not manually propelled.

"Verified" means accepted by design, evaluation, or inspection by a registered professional engineer.

"Vertical tower" means an aerial device designed to elevate a platform in a substantially vertical axis.

"Weatherproof" means so constructed that exposure to adverse weather conditions will not affect or interfere with the proper use or functions of the equipment or component.

"Winding drum hoist" means a type of hoisting machine that accumulates the suspension wire rope on the hoisting drum.

"Working platform" means suspended or supported equipment intended to provide access to the face of a building and manned by persons engaged in building maintenance.

"Wrap" means one complete turn of the suspension wire rope around the surface of a hoist drum. [Eff. 12/6/82; am 8/16/84; am and comp 3/22/91] (Auth: HRS §396-4) (Imp: HRS §396-4)

§12-83-2 <u>Powered platforms for exterior and interior building maintenance</u>. (a) General. This section covers powered platform installations permanently dedicated to interior or exterior building maintenance of a specific structure or group of structures. Building maintenance includes, but is not limited to, such working tasks as window cleaning, caulking, metal polishing, and reglazing. This section does not apply to suspended scaffolds (swinging scaffolds) used to service buildings on a temporary basis that are covered under chapter 12-82; nor does this section apply to suspended scaffolds used for construction work, covered under chapter 12-130.

(b) Application.

(1) New installations. This section applies to all permanent installations completed after July 23, 1990. Major modifications to existing installations completed after that date are also considered new installations under this section.

(2) Existing installations.

(A) Permanent installations in existence or completed before July 23, 1990 shall comply with subsections (f), (g), (h), (i), and appendix C of this section.

(B) In addition, permanent installations completed after August 27, 1971, and in existence or completed before July 23, 1990, shall comply with appendix D of this section.

(c) Assurance.

(1) Building owners of new installations shall inform the employer before each use in writing that the installation meets the requirements of subsections (d)(1) and (e)(1) and the additional design criteria contained in other provisions of subsections (d) and (e) relating to:

(A) Required load sustaining capabilities of platforms, building components, hoisting and supporting equipment;

(B) Stability factors for carriages, platforms, and supporting equipment;

(C) Maximum horizontal force for movement of carriages and davits;

(D) Design of carriages, hoisting machines, wire rope, and stabilization systems; and

(E) Design criteria for electrical wiring and equipment.

(2) Building owners shall base the information required in paragraph (1) above on the results of a field test of the installation before being placed into service and following any major alteration to an existing installation, as required in subsection (f)(1). The assurance shall also be based on all other relevant available information, including, but not limited to, test data, equipment specifications and verification by a registered professional engineer.

(3) Building owners of all installations, new and existing, shall inform the employer in writing that the installation has been inspected, tested, and maintained in compliance with the requirements of subsections (f) and (g) and that fall protection anchorages meet the requirements of paragraph (I)(c)(10) of appendix C of this section.

(4) The employer shall not permit employees to use the installation prior to receiving assurance from the building owner that the installation meets the

requirements contained in paragraphs (1) and (3) above.

(d) Powered platform installations--affected parts of buildings.

(1) General requirements. The following requirements apply to affected parts of buildings which utilize working platforms for building maintenance.

(A) Structural supports, tie-downs, tie-in guides, anchoring devices and any affected parts of the building included in the installation shall be designed by or under the direction of a registered professional engineer experienced in such design;

(B) Exterior installations shall be capable of withstanding prevailing climatic conditions;

(C) The building installation shall provide safe access to, and egress from the equipment and sufficient space to conduct necessary maintenance of the equipment;

(D) The affected parts of the building shall have the capability to sustaining all the loads imposed by the equipment; and

(E) The affected parts of the building shall be designed so as to allow the equipment to be used without exposing employees to a hazardous condition.

(2) Tie-in guides.

(A) The exterior of each building shall be provided with tie-in guides unless the conditions in subparagraphs (B) or (C) below are met.

Note: See Figure 1 in appendix B of this section for a description of a typical continuous stabilization system utilizing tie-in guides.

(B) If angulated roping is employed, tie-in guides required in subparagraph (A) above may be eliminated for not more than 75 feet (22.9 m) of the uppermost elevation of the building, if infeasible due to exterior building design, provided an angulation force of at least 10 pounds (44.4 n) is maintained under all conditions of loading.

(C) Tie-in guides required in subparagraph (A) above may be eliminated if one of the guide systems in subparagraph (D)(i), (ii) or (iii) below is provided, or an equivalent.

(D) Intermittent stabilization system. The system shall keep the equipment in continuous contact with the building facade, and shall prevent sudden horizontal movement of the platform. The system may be used together with continuous positive building guide systems using tie-in guides on the same building,

provided the requirements for each system are met.

(i) The maximum vertical interval between building anchors shall be three floors or 50 feet (15.3 m), whichever is less.

(ii) Building anchors shall be located vertically so that attachment of the stabilizer ties will not cause the platform suspension ropes to angulate the platform horizontally across the face of the building. The anchors shall be positioned horizontally on the building face so as to be symmetrical around the platform suspension ropes.

(iii) Building anchors shall be easily visible to employees and shall allow a stabilizer tie attachment for each of the platform suspension ropes at each vertical interval. If more than two suspension ropes are used on a platform, only the two building-side suspension ropes at the platform ends shall require a stabilizer attachment.

(iv) Building anchors which extend beyond the face of the building shall be free of sharp edges or points. Where cables, suspension wire ropes and lifelines may be in contact with the building face, external building anchors shall not interfere with their handling or operation.

(v) The intermittent stabilization system building anchors and components shall be capable of sustaining without failure at least four times the maximum anticipated load applied or transmitted to the components and anchors. The minimum design wind load for each anchor shall be 300 (1334 n) pounds, if two anchors share the wind load.

(vi) The building anchors and stabilizer ties shall be capable of sustaining anticipated horizontal and vertical loads from winds specified for roof storage design which may act on the platform and wire ropes if the platform is stranded on a building face. If the building anchors have different spacing than the suspension wire rope or if the building requires different suspension spacings on one platform, one building anchor and stabilizer tie shall be capable of sustaining the wind loads.

Note: See Figure 2 in appendix B of this section for

a description of a typical intermittent stabilization system.

(E) Button guide stabilization system.

(i) Guide buttons shall be coordinated with platform mounted equipment of subsection (e)(5)(A) below.

(ii) Guide buttons shall be located horizontally on the building face so as to allow engagement of each of the guide tracks mounted on the platform.

(iii) Guide buttons shall be located in vertical rows on the building face for proper engagement of the guide tracks mounted on the platform.

(iv) Two guide buttons shall engage each guide track at all times except for the initial engagement.

(v) Guide buttons which extend beyond the face of the building shall be free of sharp edges or points. Where cables, ropes, and lifelines may be in contact with the building face, guide buttons shall not interfere with their handling or operation.

(vi) Guide buttons, connections and seals shall be capable of sustaining without damage at least the weight of the platform, or provisions shall be made in the guide track or guide track connectors to prevent the platform and its attachments from transmitting the weight of the platform to the guide buttons, connections and seals. In either case, the minimum design load shall be 300 pounds (1334 N) per building anchor.

Note: See subsection (e)(5)(A) for relevant equipment provisions and Figure 3 in appendix B of this section for a description of a typical button guide stabilization system.

(F) System utilizing angulated roping and building face rollers. The system shall keep the equipment in continuous contact with the building facade, and shall prevent sudden horizontal movement of the platform. This system is acceptable only where the suspended portion of the equipment in use does not exceed 130 feet (39.6 m) above a safe surface or ground level, and where the platform maintains no less than 10 pounds (44.4 n) angulation force on the building facade.

(G) Tie-in guides for building interiors (atriums) may be eliminated when a registered professional engineer

determines that an alternative stabilization system, including systems in subparagraph (D)(i), (ii), and (iii) above, or a platform tie-off at each work station will provide equivalent safety.

(3) Roof guarding.

(A) Employees working on roofs while performing building maintenance shall be protected by a perimeter guarding system which meets the requirements of subsection (c)(1) above.

(B) The perimeter guard shall not be more than six inches (152 mm) inboard of the inside face of a barrier, i.e. the parapet wall, or roof edge curb of the building being serviced; however, the perimeter guard location shall not exceed an 18-inch (457 mm) setback from the exterior building face.

(4) Equipment stops. Operational areas for trackless type equipment shall be provided with structural stops, such as curbs, to prevent equipment from traveling outside its intended travel areas and to prevent a crushing or shearing hazard.

(5) Maintenance access. Means shall be provided to traverse all carriages and their suspended equipment to a safe area for maintenance and storage.

(6) Elevated track.

(A) An elevated track system which is located four feet (1.2 m) or more above a safe surface, and traversed by carriage supported equipment, shall be provided with a walkway and guardrail system; or

(B) The working platform shall be capable of being lowered, as part of its normal operation, to the lower safe surface for access and egress of the personnel and shall be provided with a safe means of access and egress to the lower safe surface.

(7) Tie-down anchors. Imbedded tie-down anchors, fasteners, and affected structures shall be resistant to corrosion.

(8) Cable stabilization.

(A) Hanging lifelines and all cables not in tension shall be stabilized at each 200 foot (61 m) interval of vertical travel of the working platform beyond an initial 200 foot (61 m) distance.

(B) Hanging cables, other than suspended wire ropes, which are in constant tension shall be stabilized when the vertical travel exceeds an initial 600 foot (183 m) distance, and at further intervals of 600 feet (183 m) or less.

(9) Emergency planning. A written emergency action plan shall be developed and implemented for each kind of working

platform operation. This plan shall explain the emergency procedures which are to be followed in the event of a power failure, equipment failure, or other emergencies which may be encountered. The plan shall also explain that employees inform themselves about the building emergency escape routes, procedures, and alarm systems before operating a platform. Upon initial assignment and whenever the plan is changed, the employer shall review with each employee those parts of the plan which the employee must know to be protected in the event of an emergency.

(10) Building maintenance. Repairs or major maintenance of those building portions that provide primary support for the suspended equipment shall not affect the capability of the building to meet the requirements of this standard.

(11) Electrical requirements. The following electrical requirements apply to buildings which utilize working platforms for building maintenance.

(A) General building electrical installations shall comply with chapter 12-89, unless other specified in this section;

(B) Building electrical wiring shall be of such capacity that when full load is applied to the equipment power circuit not more than a five per cent drop from building service-vault voltage shall occur at any power circuit outlet used by equipment regulated by this section;

(C) The equipment power circuit shall be an independent electrical circuit that shall remain separate from all other equipment within or on the building, other than power circuits used for hand tools that will be used in conjunction with the equipment. If the building is provided with an emergency power system, the equipment power circuit may also be connected to this system;

(D) The power circuit shall be provided with a disconnect switch that can be locked in the "OFF" and "ON" positions. The switch shall be conveniently located with respect to the primary operating area of the equipment to allow the operators of the equipment access to the switch;

(E) The disconnect switch for the power circuit shall be locked in the "ON" position when the equipment is in use; and

(F) An effective two-way voice communication system shall be provided between the equipment operators and persons stationed within the building being serviced.

The communications facility shall be operable and shall be manned at all times by persons stationed within the building whenever the platform is being used.

(e) Powered platform installations--equipment.

(1) General requirements. The following requirements apply to equipment which are part of a powered platform installation, such as platforms, stabilizing components, carriages, outriggers, davits, hoisting machines, wire ropes, and electrical components.

(A) Equipment installations shall be designed by or under the direction of a registered professional engineer experienced in such design;

(B) The design shall provide for a minimum live load of 250 pounds (113.6 kg) for each occupant of a suspended supported platform;

(C) Equipment that is exposed to wind when not in service shall be designed to withstand forces generated by winds of at least 100 miles per hour (44.7 m/s) at 30 feet (9.2 m) above grade; and

(D) Equipment that is exposed to wind when in service shall be designed to withstand forces generated by winds of at least 50 miles per hour (22.4 m/s) for all elevations.

(2) Construction requirements. Bolted connections shall be self-locking or shall otherwise be secured to prevent loss of the connections by vibration.

(3) Suspension methods. Elevated building maintenance equipment shall be suspended by a carriage, outriggers, davits, or an equivalent method.

(A) Carriages. Carriages used for suspension of elevated building maintenance equipment shall comply with the following:

(i) The horizontal movement of a carriage shall be controlled so as to ensure its safe movement and allow accurate positioning of the platform for vertical travel or storage;

(ii) Powered carriages shall not exceed a traversing speed of 50 feet per minute (0.3 m/s);

(iii) The initiation of a traversing movement for a manually propelled carriage on a smooth level surface shall not require a person to exert a horizontal force greater than 40 pounds (444.8 n);

(iv) Structural stops and curbs shall be provided to prevent the traversing of the carriage beyond its designed limits of travel;

(v) Traversing controls for a powered carriage shall be of a continuous pressure weatherproof type. Multiple controls when provided shall be arranged to permit operation from only one control station at a time. An emergency stop device shall be provided on each end of a powered carriage for interrupting power to the carriage drive motors;

(vi) The operating control(s) shall be so connected that in the case of suspended equipment, traversing of a carriage is not possible until the suspended portion of the equipment is located at its uppermost designed position for traversing, and is free of contact with the face of the building or building guides. In addition, all protective devices and interlocks are to be in the proper position to allow traversing of the carriage;

(vii) Stability for underfoot supported carriages shall be obtained by gravity, by an attachment to a structural support, or by a combination of gravity and a structural support. The use of flowing counterweights to achieve stability is prohibited.

(a) The stability factor against overturning shall not be less than two for horizontal traversing of the carriage, including the effects of impact and wind.

(b) The carriages and their anchorages shall be capable of resisting accidental over-tensioning of the wire ropes suspending the working platform, and this calculated value shall include the effect of 1-1/2 times the stall capacity of the hoist motor. All parts of the installation shall be capable of withstanding, without damage to any part of the installation, the forces resulting from the stall load of the hoist and one half the wind load.

(c) Roof carriages which rely on having tie-down devices secured to the building to develop the required stability against overturning shall be provided with an interlock which will prevent vertical platform movement unless the tie-down is engaged;

(viii) An automatically applied braking or locking

system, or equivalent, shall be provided that will prevent unintentional traversing of power traversed or power assisted carriages;

(ix) A manual or automatic braking or locking system or equivalent, shall be provided that will prevent unintentional traversing of manually propelled carriages;

(x) A means to lock out the power supply for the carriage shall be provided;

(xi) Safe access to and egress from the carriage shall be provided from a safe surface. If the carriage traverses an elevated area, any operating area on the carriage shall be protected by a guardrail system in compliance with the provisions of paragraph (5)(A)(vii) below. Any access gate shall be self-closing and self-latching, or provided with an interlock;

(xii) Each carriage work station position shall be identified by location markings and position indicators; and

(xiii) The motors shall stall if the load on the hoist motors is at any time in excess of three times that necessary for lifting the working platform with its rated load.

(B) Transportable outriggers.

(i) Transportable outriggers may be used as a method of suspension for ground rigged working platforms where the point of suspension does not exceed 300 feet (91.5 m) above a safe surface. Tie-in guide system(s) shall be provided which meet the requirements of subsection (d)(2).

(ii) Transportable outriggers shall be used only with self-powered, ground rigged working platforms.

(iii) Each transportable outrigger shall be secured with a tie-down to a verified anchorage on the building during the entire period of its use. The anchorage shall be designed to have a stability factor of not less than four against overturning or upsetting of the outrigger.

(iv) Access to and egress from the working platform shall be to and from a safe surface below the point of suspension.

(v) Each transportable outrigger shall be designed for lateral stability to prevent roll-over in

the event an accidental lateral load is applied to the outrigger. The accidental lateral load to be considered in this design shall be not less than 70 per cent of the rated load of the hoist.

(vi) Each transportable outrigger shall be designed to support an ultimate load of not less than four times the rated load of the hoist.

(vii) Each transportable outrigger shall be so located that the suspension wire ropes for two point suspended working platforms are hung parallel.

(viii) A transportable outrigger shall be tied-back to a verified anchorage on the building with a rope equivalent in strength to the suspension rope.

(ix) The tie-back rope shall be installed parallel to the centerline of the outrigger.

(C) Davits.

(i) Every davit installation, fixed or transportable, rotatable or non-rotatable, shall be designed and installed to insure that it has a stability factor against overturning of not less than four.

(ii) The following requirements apply to roof rigged davit systems:

(a) Access to and egress from the working platform shall be from a safe surface. Access or egress shall not require persons to climb over a building's parapet or guard railing; and

(b) The working platform shall be provided with wheel casters or a carriage for traversing horizontally.

(iii) The following requirements apply to ground rigged davit systems:

(a) The point of suspension shall not exceed 300 feet (91.5 m) above a safe surface. Guide system(s) shall be provided which meet the requirements of subsection (d)(2); and

(b) Access and egress to and from the working platform shall only be from a safe surface below the point of suspension.

(iv) A rotating davit shall not require a horizontal force in excess of 40 pounds (177.9 n) per person to initiate a rotating movement.

(v) The following requirements shall apply to transportable davits:

(a) A davit or part of a davit weighing more than 80 pounds (36 kg) shall be provided with a means for its transport, which shall keep the center of gravity of the davit at or below 36 inches (914 mm) above the safe surface during transport;

(b) A davit shall be provided with a pivoting socket or with a base that will allow the insertion or removal of a davit at a position of not more than 35 degrees above the horizontal, with the complete davit inboard of the building face being serviced; and

(c) Means shall be provided to lock the davit to its socket or base before it is used to suspend the platform.

(4) Hoisting machines.

(A) Raising and lowering of suspended or supported equipment shall be performed only by a hoisting machine.

(B) Each hoisting machine shall be capable of arresting any overspeed descent of the load.

(C) Each hoisting machine shall be powered only by air, electric, or hydraulic sources.

(D) Flammable liquids shall not be carried on the working platform.

(E) Each hoisting machine shall be capable of raising or lowering 125 per cent of the rated load of the hoist.

(F) Moving parts of a hoisting machine shall be enclosed or guarded in compliance with section 12-80-2(a)(1) and (2).

(G) Winding drums, traction drums and sheaves, and directional sheaves used in conjunction with hoisting machines shall be compatible with, and sized for, the wire rope used.

(H) Each winding drum shall be provided with a positive means of attaching the wire rope to the drum. The attachment shall be capable of developing at least four times the rated load of the hoist.

(I) Each hoisting machine shall be provided with a primary brake and at least one independent secondary brake, each capable of stopping and holding not less than 125 per cent of the lifting capacity of the hoist.

(i) The primary brake shall be directly connected

to the drive train of the hoisting machine, and shall not be connected through belts, chains, clutches, or set screw type devices. The brake shall automatically set when power to the prime mover is interrupted.

(ii) The secondary brake shall be an automatic emergency type of brake that, if actuated during each stopping cycle, shall not engage before the hoist is stopped by the primary brake.

(iii) When a secondary brake is actuated, it shall stop and hold the platform within a vertical distance of 24 inches (609.6 mm).

(J) Any component of a hoisting machine which requires lubrication for its protection and proper functioning shall be provided with a means for that lubrication to be applied.

(5) Suspended equipment.

(A) General requirements.

(i) Each suspended unit component, except suspension ropes and guardrail systems, shall be capable of supporting, without failure, at least four times the maximum intended live load applied or transmitted to that component.

(ii) Each suspended unit component shall be constructed of materials that will withstand anticipated weather conditions.

(iii) Each suspended unit shall be provided with a load rating plate, conspicuously located, stating the unit weight and rated load of the suspended unit.

(iv) When the suspension points on a suspended unit are not at the unit ends, the unit shall be capable of remaining continuously stable under all conditions of use and position of the live load, and shall maintain at least a 1.5 to 1 stability factor against unit upset.

(v) Guide rollers, guide shoes, or building face rollers shall be provided, and shall compensate for variations in building dimensions and for minor horizontal out-of-level variations of each suspended unit.

(vi) Each working platform of a suspended unit shall be secured to the building facade by one or more of the following methods, or by an equivalent method:

(a) Continuous engagement to building anchors as provided in subsection (d)(2)(A);
(b) Intermittent engagement to building anchors as provided in subsection (d)(2)(D);
(c) Button guide engagement as provided in subsection (d)(2)(E); or
(d) Angulated roping and building face rollers as provided in subsection (d)(2)(B).

(vii) Each working platform of a suspended unit shall be provided with a guardrail system on all sides which shall meet the following requirements:
(a) The system shall consist of a top guardrail, midrail, and a toeboard;
(b) The top guardrail shall not be less than 36 inches (914 mm) high and shall be able to withstand at least a 100-pound (444 n) force in any downward or outward direction;
(c) The midrail shall be able to withstand at least a 75-pound (333 n) force in any downward or outward direction; and
(d) The areas between the guardrail and toeboard on the ends and outboard side, and the area between the midrail and toeboard on the inboard side, shall be closed with a material that is capable of withstanding a load of 100 pounds (45.4 Kg) applied horizontally over any area of one square foot (.09 m^2). The material shall have all openings small enough to reject passage of life lines and potential falling objects which may be hazardous to persons below.
(e) Toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds (222 n) applied in any downward or horizontal direction at any point along the toeboard.
(f) Toeboards shall be 3-1/2 inches (9 cm) minimum in length from their top edge to the level of the platform floor.
(g) Toeboards shall be securely fastened in place at the outermost edge of the platform and have no more than 1/2 inch (1.3 cm) clearance above the platform

floor.

(h) Toeboards shall be solid or with an opening not over one inch (2.5 cm) in the greatest dimension.

(B) Two and four-point suspended working platforms.

(i) The working platform shall be not less than 24 inches (610 mm) wide and shall be provided with a minimum of a 12-inch (305 mm) wide passage at or past any obstruction on the platform.

(ii) The flooring shall be of a slip-resistant type and shall contain no opening that would allow the passage of life lines, cables, and other potential falling objects. If a larger opening is provided, it shall be protected by placing a material under the opening which shall prevent the passage of life lines, cables, and potential falling objects.

(iii) The working platform shall be provided with a means of suspension that will restrict the platform's inboard to outboard roll about its longitudinal axis to a maximum of 15 degrees from a horizontal plane when moving the live load from the inboard to the outboard side of the platform.

(iv) Any cable suspended from above the platform shall be provided with a means for storage to prevent accumulation of the cable on the floor of the platform.

(v) All operating controls for the vertical travel of the platform shall be of the continuous-pressure type, and shall be located on the platform.

(vi) Each operating station of every working platform shall be provided with a means of interrupting the power supply to all hoist motors to stop any further powered ascent or descent of the platform.

(vii) The maximum rated speed of the platform shall not exceed 50 feet per minute (0.3 ms) with single speed hoists, nor 75 feet per minute (0.4 ms) with multi-speed hoists.

(viii) Provisions shall be made for securing all tools, water tanks, and other accessories to prevent their movement or accumulation on the floor of the platform.

(ix) Portable fire extinguishers conforming to the provisions of sections 12-63-1 and 12-63-4

shall be provided and securely attached on all working platforms.

(x) Access to and egress from a working platform, except for those that land directly on a safe surface, shall be provided by stairs, ladders, platforms, and runways conforming to the provisions of chapter 12-82. Access gates shall be self-closing and self-latching.

(xi) Means of access to or egress from a working platform which is 48 inches (1.2 m) or more above a safe surface shall be provided with a guardrail system or ladder handrails that conform to the provisions of chapter 12-82.

(xii) The platform shall be provided with a secondary wire rope suspension system if the platform contains overhead structures which restrict the emergency egress of employees. A horizontal lifeline or a direct connection anchorage shall be provided, as part of a fall arrest system which meets the requirements of appendix C of this section, for each employee on such a platform.

(xiii) A vertical lifeline shall be provided as part of a fall arrest system which meets the requirements of appendix C of this section, for each employee on a working platform suspended by two or more wire ropes, if the failure of one wire rope or suspension attachment will cause the platform to upset. If a secondary wire rope suspension is used, vertical lifelines are not required for the fall arrest system, provided that each employee is attached to a horizontal lifeline anchored to the platform.

(xiv) An emergency electric operating device shall be provided on roof powered platforms near the hoisting machine for use in the event of failure of the normal operating device located on the working platform, or failure of the cable connected to the platform. The emergency electric operating device shall be mounted in a secured compartment, and the compartment shall be labeled with instructions for use. A means for opening the compartment shall be mounted in a break-glass receptable located near the emergency electric operating device or in an equivalent secure and accessible location.

(C) Single point suspended working platforms.

(i) The requirements of subparagraph (B)(i) through (xi) above shall also apply to a single point working platform.

(ii) Each single point suspended working platform shall be provided with a secondary wire rope suspension system, which will prevent the working platform from falling should there be a failure of the primary means of support, or if the platform contains overhead structures which restrict the egress of the employees. A horizontal life line or a direct connection anchorage shall be provided, as part of a fall arrest system which meets the requirements of appendix C of this section, for each employee on the platform.

(D) Ground-rigged working platforms.

(i) Ground-rigged working platforms shall comply with all the requirements of subparagraph (B)(i) through (xiv) above.

(ii) After each day's use, the power supply within the building shall be disconnected from a ground-rigged working platform, and the platform shall be either disengaged from its suspension points or secured and stored at grade.

(E) Intermittently stabilized platforms.

(i) The platform shall comply with subparagraph (B)(i) through (xiv) above.

(ii) Each stabilizer tie shall be equipped with a "quick connect-quick disconnect" device which cannot be accidently disengaged, for attachment to the building anchor, and shall be resistant to adverse environmental conditions.

(iii) The platform shall be provided with a stopping device that will interrupt the hoist power supply in the event the platform contacts a stabilizer tie during its ascent.

(iv) Building face rollers shall not be placed at the anchor setting if exterior anchors are used on the building face.

(v) Stabilizer ties used on intermittently stabilized platforms shall allow for the specific attachment length needed to effect the predetermined angulation of the suspended wire rope. The specific attachment length shall be maintained at all building anchor locations.

(vi) The platform shall be in continuous contact with the face of the building during ascent and descent.

(vii) The attachment and removal of stabilizer ties shall not require the horizontal movement of the platform.

(viii) The platform-mounted equipment and its suspension wire ropes shall not be physically damaged by the loads from the stabilizer tie or its building anchor. The platform, platform mounted equipment, and wire ropes shall be able to withstand a load that is at least twice the ultimate strength of the stabilizer tie.

Note: See Figure II in appendix B of this section for a description of a typical intermittent stabilization system.

(F) Button guide stabilized platforms.

(i) The platform shall comply with subparagraph (B)(i) through (xiv) above.

(ii) Each guide track on the platform shall engage a minimum of two guide buttons during any vertical travel of the platform following the initial button engagement.

(iii) Each guide track on a platform that is part of a roof rigged system shall be provided with a storage position on the platform.

(iv) Each guide track on the platform shall be sufficiently maneuverable by platform occupants to permit easy engagement of the guide buttons, and easy movement into and out of its storage position on the platform.

(v) Two guide tracks shall be mounted on the platform and shall provide continuous contact with the building face.

(vi) The load carrying components of the button guide stabilization system which transmit the load into the platform shall be capable of supporting the weight of the platform, or provision shall be made in the guide track connectors or platform attachments to prevent the weight of the platform from being transmitted to the platform attachments.

Note: See Figure III in appendix B of this section for a description of a typical button guide stabilization system.

(6) Supported equipment.

(A) Supported equipment shall maintain a vertical

position in respect to the face of the building by means other than friction.

(B) Cog wheels or equivalent means shall be incorporated to provide climbing traction between the supported equipment and the building guides. Additional guide wheels or shoes shall be incorporated as may be necessary to ensure that the drive wheels are continuously held in positive engagement with the building guides.

(C) Launch guide mullions indexed to the building guides and retained in alignment with the building guides shall be used to align drive wheels entering the building guides.

(D) Manned platforms used on supported equipment shall comply with the requirements of paragraph (B)(i), (ii), and (iv) through (xi) above covering suspended equipment.

(7) Suspension wire ropes and rope connections.

(A) Each specific installation shall use suspension wire ropes or combination cable and connections meeting the specification recommended by the manufacturer of the hoisting machine used. Connections shall be capable of developing at least 80 per cent of the rated braking strength of the wire rope.

(B) Each suspension rope shall have a "design factor" of at least 10. The "design factor" is the ratio of the rated strength of the suspension wire rope to the rated working load, and shall be calculated using the following formula:

$$F = \frac{S\,(N)}{W}$$

Where:

F = Design factor
S = Manufacturer's rated strength of one suspension rope
N = Number of suspension ropes under load
W = Rated working load on all ropes at any point of travel

(C) Suspension wire rope grade shall be at least improved plow steel or equivalent.

(D) Suspension wire ropes shall be sized to conform with

the required design factor, but shall not be less than 5/16 inch (7.94 mm) in diameter.

(E) No more than one reverse bend in six wire rope lays shall be permitted.

(F) A corrosion-resistant tag shall be securely attached to one of the wire rope fastenings when a suspension wire rope is to be used at a specific location and will remain in that location. This tag shall bear the following wire rope data:

(i) The diameter (inches and/or mm);

(ii) Construction classification;

(iii) Whether non-preformed or preformed;

(iv) The grade of material;

(v) The manufacturer's rated strength;

(vi) The manufacturer's name;

(vii) The month and year the ropes were installed; and

(viii) The name of the person or company which installed the ropes.

(G) A new tag shall be installed at each rope renewal.

(H) The original tag shall be stamped with the date of the resocketing, or the original tag shall be retained and a supplemental tag shall be provided when ropes are resocketed. The supplemental tag shall show the date of resocketing and the name of the person or company that resocketed the rope.

(I) Winding drum type hoists shall contain at least three wraps of the suspension wire rope on the drum when the suspended unit has reached the lowest possible point of its vertical travel.

(J) Traction drum and sheave type hoists shall be provided with a wire rope of sufficient length to reach the lowest possible point of vertical travel of the suspended unit, and an additional length of the wire rope of at least four feet (1.2 m).

(K) The lengthening or repairing of suspension wire ropes is prohibited.

(L) Babbitted fastenings for suspension wire rope are prohibited.

(8) Control circuits, power circuits, and their components.

(A) Electrical wiring and equipment shall comply with chapter 12-89, except as otherwise required by this section.

(B) Electrical runway conductor systems shall be of a type designed for use in exterior locations, and shall be located so that they do not come into contact with accumulated snow or water.

(C) Cables shall be protected against damage resulting from overtensioning or from other causes.

(D) Devices shall be included in the control system for the equipment which will provide protection against electrical overloads, three phase reversal, and phase failure. The control system shall have a separate method, independent of the direction control circuit, for breaking the power circuit in case of an emergency or malfunction.

(E) Suspended or supported equipment shall have a control system which will require the operator of the equipment to follow predetermined procedures.

(F) The following requirements shall apply to electrical protection devices:

(i) On installations where the carriage does not have a stability factor of at least four against overturning, electrical contact(s) shall be provided and so connected that the operating devices for the suspended or supported equipment shall be operative only when the carriage is located and mechanically retained at an established operating point.

(ii) Overload protection shall be provided in the hoisting or suspension system to protect against the equipment operating in the "up" direction with a load in excess of 125 per cent of the rated load of the platform; and

(iii) An automatic detector shall be provided for each suspension point that will interrupt power to all hoisting motors for travel in the "down" direction, and apply the primary brakes if any suspension wire rope becomes slack. A continuous-pressure rigging-bypass switch designed for use during rigging is permitted. This switch shall only be used during rigging.

(G) Upper and lower directional switches designed to prevent the travel of suspended units beyond safe upward and downward levels shall be provided.

(H) Emergency stop switches shall be provided on remote controlled, roof-powered manned platforms adjacent to each control station on the platform.

(I) Cables which are in constant tension shall have overload devices which will prevent the tension in the cable from interfering with the load limiting device required in subparagraph (F)(ii) above, or with the platform roll limiting device required in subsection (e)(5)(B)(iii). The setting of these

devices shall be coordinated with other overload settings at the time of design of the system, and shall be clearly indicated on or near the device. The device shall interrupt the equipment travel in the "down" direction.

(f) Inspection and tests.

(1) Installations and alterations. All completed building maintenance equipment installations shall be inspected and tested in the field before being placed in initial service to determine that all parts of the installation conform to applicable requirements of this standard, and that all safety and operating equipment is functioning as required. A similar inspection and test shall be made following any major alteration to an existing installation. No hoist in an installation shall be subjected to a load in excess of 125 per cent of its rated load.

(2) Periodic inspections and tests.

(A) Related building supporting structures shall undergo periodic inspection by a competent person at intervals not exceeding 12 moths.

(B) All parts of the equipment including control systems shall be inspected, and where necessary, tested by a competent person at intervals specified by the manufacturer/supplier, but not to exceed 12 months, to determine that they are in safe operating condition. Parts subject to wear, such as wire ropes, bearings, gears, and governors shall be inspected and tested to determine that they have not worn to such an extent as to affect the safe operation of the installation.

(C) The building owner shall keep a certification record of each inspection and test required under subparagraphs (A) and (B) above. The certification record shall include the date of the inspection, the signature of the person who performed the inspection, and the number, or other identifier, of the building support structure and equipment which was inspected. This certification record shall be kept readily available for review by the director or the director's representative and by the employer.

(D) Working platforms and their components shall be inspected by the employer for visible defects before every use and after each occurrence which could affect the platform's structural integrity.

(3) Maintenance inspections and tests.

(A) A maintenance inspection and, where necessary, a test shall be made of each platform installation every 30

days, or where the work cycle is less than 30 days, such inspection or test shall be made prior to each work cycle. This inspection and test shall follow procedures recommended by the manufacturer, and shall be made by a competent person.

(B) The building owner shall keep a certification record of each inspection and test performed under subparagraph (A) above. The certification record shall include the date of the inspection and test, the signature of the person who performed the inspection and test, and an identifier for the platform installation which was inspected. The certification record shall be kept readily available for review by the director or the director's representative and by the employer.

(4) Special inspection of governors and secondary brakes.

(A) Governors and secondary brakes shall be inspected and tested at intervals specified by the manufacturer/supplier but not to exceed every 12 months.

(B) The results of the inspection and test shall confirm that the initiating device for the secondary braking system operates at the proper overspeed.

(C) The results of the inspection and test shall confirm that the secondary brake is functioning properly.

(D) If any hoisting machine or initiating device for the secondary brake system is removed from the equipment for testing, all reinstalled and directly related components shall be reinspected prior to returning the equipment installation to service.

(E) Inspection of governors and secondary brakes shall be performed by a competent person.

(F) The secondary brake governor and actuation device shall be tested before each day's use. Where testing is not feasible, a visual inspection of the brake shall be made instead to ensure that it is free to operate.

(5) Suspension wire rope maintenance, inspection, and replacement.

(A) Suspension wire rope shall be maintained and used in accordance with procedures recommended by the wire rope manufacturer.

(B) Suspension wire rope shall be inspected by a competent person for visible defects and gross damage to the rope before every use and after each occurrence which might affect the wire rope's integrity.

(C) A thorough inspection of suspension wire ropes in service shall be made once a month. Suspension wire ropes that have been inactive for 30 days or longer shall have a thorough inspection before they are placed into service. These thorough inspections of suspension wire ropes shall be performed by a competent person.

(D) The need for replacement of a suspension wire rope shall be determined by inspection and shall be based on the condition of the wire rope. Any of the following conditions or combination of conditions will be cause for removal of the wire rope:

(i) Broken wires exceeding three wires in one strand or six wires in one rope lay;

(ii) Distortion of rope structure such as would result from crushing or kinking;

(iii) Evidence of heat damage;

(iv) Evidence of rope deterioration from corrosion;

(v) A broken wire within 18 inches (460.8 mm) of the end attachments;

(vi) Noticeable rusting and pitting;

(vii) Evidence of core failure (a lengthening of rope lay, protrusion of the rope core and a reduction in rope diameter suggests core failure);

(viii) More than one valley break (broken wire);

(ix) Outer wire wear exceeds one-third of the original outer wire diameter; or

(x) Any other condition which the competent person determines has significantly affected the integrity of the rope.

(E) The building owner shall keep a certification record of each monthly inspection of a suspension wire rope as required in subparagraph (C) above. The record shall include the date of the inspection, the signature of the person who performed the inspection, and a number, or other identifier, of the wire rope which was inspected. This record of inspection shall be made available for review by the director or the director's representative and by the employer.

(6) Hoist inspection. Before lowering personnel below the top elevation of the building, the hoist shall be tested each day in the lifting direction with the intended load to make certain it has sufficient capacity to raise the personnel back to the boarding level.

(g) Maintenance.

(1) General maintenance. All parts of the equipment affecting

safe operation shall be maintained in proper working order so that they may perform the functions for which they were intended. The equipment shall be taken out of service when it is not in proper working order.

(2) Cleaning.

(A) Control or power contractors and relays shall be kept clean.

(B) All other parts shall be kept clean if their proper functioning would be affected by the presence of dirt or other contaminants.

(3) Periodic resocketing of wire rope fastenings.

(A) Hoisting ropes utilizing poured socket fastenings shall be resocketed at the non-drum ends at intervals not exceeding 24 months. In resocketing the ropes, a sufficient length shall be cut from the end of the rope to remove damaged or fatigued portions.

(B) Resocketed ropes shall conform to the requirements of subsection (e)(7)(H).

(C) Limit switches affected by the resocketed ropes shall be reset, if necessary.

(4) Periodic reshackling of suspension wire ropes. The hoisting ropes shall be reshackled at the non-drum ends at intervals not exceeding 24 months. When reshackling the ropes, a sufficient length shall be cut from the end of the rope to remove damaged or fatigued portions.

(5) Roof systems. Roof track systems, tie downs, or similar equipment shall be maintained in proper working order so that they perform the function for which they were intended.

(6) Building face guiding members. T-rails, indented mullions, or equivalent guides located in the face of a building shall be maintained in proper working order so that they perform the functions for which they were intended. Brackets for cable stabilizers shall similarly be maintained in proper working order.

(7) Inoperative safety devices. No person shall render a required safety device or electrical protective device inoperative, except as necessary for tests, inspections, and maintenance. Immediately upon completion of such tests, inspections and maintenance, the device shall be restored to its normal operating condition.

(h) Operations.

(1) Training.

(A) Working platforms shall be operated only by persons who are proficient in the operation, safe use, and inspection of the particular working platform to be operated.

(B) All employees who operate working platforms shall be trained in the following:
(i) Recognition of, and preventive measures for, the safety hazards associated with their individual work tasks;
(ii) General recognition and prevention of safety hazards associated with the use of working platforms, including the provisions in the section relating to the particular working platform to be operated;
(iii) Emergency action plan procedures required in subsection (d)(9);
(iv) Work procedures required in subparagraph (D) below; and
(v) Personal fall arrest system inspection, care, use, and system performance.

(C) Training of employees in the operation and inspection of working platforms shall be done by a competent person.

(D) Written work procedures for the operation, safe use, and inspection of working platforms shall be provided for employee training. Pictorial methods of instruction, may be used, in lieu of written work procedures, if employee communication is improved using this method. The operating manuals supplied by manufacturers for platform system components can serve as the basis for these procedures.

(E) The employer shall certify that employees have been trained in operating and inspecting a working platform by preparing a certification record which includes the identity of the person trained, the signature of the employer or the person who conducted the training, and the date that training was completed. The certification record shall be prepared at the completion of the training required in subparagraph (B) above, and shall be maintained in a file for the duration of the employee's employment. The certification record shall be kept readily available for review by the director or director's representative.

(2) Use.

(A) Working platforms shall not be loaded in excess of the rated load, as stated on the platform load rating plate.

(B) Employees shall be prohibited from working on snow, ice, or other slippery material covering platforms, except following the removal of such materials.

(C) Adequate precautions shall be taken to protect the platform, wire ropes, and life lines from damage due to acids or other corrosive substances, in accordance with the recommendations of the corrosive substance producer, supplier, platform manufacturer, or other equivalent information sources. Platform materials and equipment exposed to acids or other corrosive substances shall be washed down with a neutralizing solution, at a frequency recommended by the corrosive substance producer or supplier.

(D) Platform materials, equipment, wire ropes, and life lines shall be protected when using a heat producing process. Wire ropes and life lines which have been contacted by the heat producing process shall be considered to be permanently damaged and shall not be used.

(E) The platform shall not be operated in winds in excess of 25 miles per hour (40.2 km/hr) except to move it from an operating to a storage position. Wind speed shall be determined based on the best available information, which includes on-site anemometer readings and local weather forecasts which predict wind velocities for the area.

(F) On exterior installations, an anemometer shall be mounted on the platform to provide information of on-site wind velocities prior to and during the use of the platform. The anemometer may be a portable (hand held) unit which is temporarily mounted during platform use.

(G) Tools, materials, and debris not related to the work in progress shall not be allowed to accumulate on platforms. Stabilizer ties shall be located so as to allow unencumbered passage along the full length of the platform and shall be of such length so as not to become entangled in rollers, hoists or other machinery.

(i) Personal fall protection. Employees on working platforms shall be protected by a personal fall arrest system meeting the requirements of appendix C of this section, and as otherwise provided by this section.

Appendix A
GUIDELINES (ADVISORY)

1. Use of the Appendix. Appendix A provides examples of equipment and methods to assist the employer in meeting the requirements of the indicated provision of the standard. Employers may use other equipment or procedures which conform to the requirements of the standard. This appendix neither adds to nor detracts from the mandatory requirements set forth in section 12-83-2.

2. Assurance. Section 12-83-2(c) requires the building owner to inform the employer in writing that the powered platform installation complies with certain requirements of the standard, since the employer may not have the necessary information to make these determinations. The employer, however, remains responsible for meeting these requirements which have not been set off in section 12-83-2(c)(1).

3. Design Requirements. The design requirements for each installation should be based on the limitations (stresses, deflections, etc.), established by nationally recognized standards as promulgated by the following organizations, or to equivalent standards:

AA - The Aluminum Association, 818 Connecticut Avenue, NW., Washington, D.C. 20006
Aluminum Construction Manual
Specifications For Aluminum Structures
Aluminum Standards and Data

AGMA - American Gear Manufacturers Association, 101 North Fort Meyer Dr., Suite 1000, Arlington, VA 22209

AISC - American Institute of Steel Construction, 400 North Michigan Avenue, Chicago, IL 60611

ANSI - American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018

ASCE - American Society of Civil Engineers, 345 East 47th Street, New York, NY 10017

ASME - American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017

ASTM - American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103

AWS - American Welding Society, Inc., Box 351040, 550 NW. Lejeunne Road, Miami, FL 33126

JIC - Joint Industrial Council, 2139 Wisconsin Avenue NW., Washington, D.C. 20007

NEMA - National Electric Manufacturers Association, 2101 L Street, NW., Washington, D.C. 20037

4. Tie-in-guides. Indented mullions, T-rails or other equivalent guides are acceptable as tie-in-guides in a building face for a continuous stabilization system. Internal guides are embedded in other building members with only the opening exposed (see Figure 1 of appendix B). External guides, however, are installed external to the other building members and so are fully exposed. The minimum opening for tie-in-guides is three-quarters of an inch (19 mm), and the minimum inside dimensions are one-inch (25 mm) deep and two inches (50 mm) wide.

   Employers should be aware of the hazards associated with tie-in guides in a continuous stabilization system which was not designed properly. For example, joints in these track systems may become extended or discontinuous due to installation or building settlement. If this alignment problem is not corrected, the system could jam when a guide roller or guide shoe strikes a joint and this would cause a hazardous situation for employees. In another instance, faulty design will result in guide rollers being mounted in a line so they will jam in the track at the slightest misalignment.

5. Building anchors (intermittent stabilization system). In the selection of the vertical distance between building anchors, certain factors should be given consideration. These factors include building height and architectural design, platform length and weight, wire rope angulation, and the wind velocities in the building area. Another factor to consider is the material of the building face, since this material may be adversely affected by the building rollers.

   External or indented type building anchors are acceptable. Receptacles in the building facade used for the indented type should be kept clear of extraneous materials which will hinder their use. During the inspection of the platform installation, evidence of a failure or abuse of the anchors should be brought to the attention of the employer.

6. Stabilizer tie length. A stabilizer tie should be long enough to provide for the planned angulation of the suspension cables. However, the length of the tie should not be excessive and become a problem by possibly becoming entangled in the building face rollers or parts of the platform machinery.

   The attachment length may vary due to material elongation and this should be considered when selecting the material to be used. Consideration should also be given to the use of ties which are easily installed by employees, since this will

encourage their use.

7. Intermittent stabilization system. Intermittent stabilization systems may use different equipment, tie-in devices and methods to restrict the horizontal movement of a powered platform with respect to the face of the building. One acceptable method employs corrosion-resistant building anchors secured in the face of the building in vertical rows every third floor or 50 feet (15.3 m), whichever is less. The anchors are spaced horizontally to allow a stabilization attachment (stabilizer tie) for each of the two platform suspension wire ropes. The stabilizer tie consists of two parts. One part is a quick connect-quick disconnect device which utilizes a corrosion-resistant yoke and retainer spring that is designed to fit over the building anchors. The second part of the stabilizer tie is a lanyard which is used to maintain a fixed distance between the suspension wire rope and the face of the building.

   In this method, as the suspended powered platform descends past the elevation of each anchor, the descent is halted and each of the platform occupants secures a stabilizer tie between a suspension wire rope and a building anchor. The procedure is repeated as each elevation of a building anchor is reached during the descent of the powered platform.

   As the platform ascends, the procedure is reversed; that is, the stabilizer ties are removed as each elevation of a building anchor is reached. The removal of each stabilizer tie is assured since the platform is provided with stopping devices which will interrupt power to its hoist(s) in the event either stopping device contacts a stabilizer during the ascent of the platform.

   Figure 2 of appendix B illustrates another type of acceptable intermittent stabilization system which utilizes retaining pins as the quick connect-quick disconnect device in the stabilizer tie.

8. Wire Rope Inspection. The inspection of the suspension wire rope is important since the rope gradually loses strength during its useful life. The purpose of the inspection is to determine whether the wire rope has sufficient integrity to support a platform with the required design factor.

   If there is any doubt concerning the condition of a wire rope or its ability to perform the required work, the rope should be replaced. The cost of wire rope replacement is quite small if

compared to the cost in terms of human injuries, equipment down time and replacement.

No listing of critical inspection factors, which serve as a basis for wire rope replacement in the standard, can be a substitute for an experienced inspector of wire rope. The listing serves as a user's guide to the accepted standards by which ropes must be judged.

Rope life can be prolonged if preventive maintenance is performed regularly. Cutting off an appropriate length of rope at the end termination before the core degrades and valley breaks appear minimizes degradation at these sections.

9. General Maintenance. In meeting the general maintenance requirement in section 12-83-2(g)(1), the employer should undertake the prompt replacement of broken, worn and damaged parts, switch contacts, brushes, and short flexible conductors of electrical devices. The components of the electrical service system and traveling cables should be replaced when damaged or significantly abraded. In addition, gears, shafts, bearings, brakes and hoisting drums should be kept in proper alignment.

10. Training. In meeting the training requirement of section 12-83-2(h)(1), employers should use both on the job training and formal classroom training. The written work procedures used for this training should be obtained from the manufacturer, if possible, or prepared as necessary for the employee's information and use.

Employees who will operate powered platforms with intermittent stabilization systems should receive instruction in the specific ascent and descent procedures involving the assembly and disassembly of the stabilizer ties.

An acceptable training program should also include employee instruction in basic inspection procedures for the purpose of determining the need for repair and replacement of platform equipment. In addition, the program should cover the inspection, care and use of the personal fall protection equipment required in section 12-83-2(i)(1).

In addition, the training program should also include emergency action plan elements. OSHA brochure #3088 (Rev.) 1985, "How to Prepare for Workplace Emergencies," details the basic steps needed to prepare to handle emergencies in the workplace.

Following the completion of a training program, the employee should be required to demonstrate competency in operating the equipment safely. Supplemental training of the employee should be provided by the employer, as necessary, if the equipment used or other working conditions should change.

An employee who is required to work with chemical products on a platform should receive training in proper cleaning procedures, and in the hazards, care and handling of these products. In addition, the employee should be supplied with the appropriate personal protective equipment, such as gloves and eye and face protection.

11. Suspension and Securing of Powered Platforms (Equivalency). One acceptable method of demonstrating the equivalency of a method of suspending or securing a powered platform, as required in section 12-83-2(d)(2)(C), (e)(3) and (e)(5)(A)(vi), is to provide an engineering analysis by a registered professional engineer. The analysis should demonstrate that the proposed method will provide an equal or greater degree of safety for employees than any one of the methods specified in the standard.

Appendix B
EXHIBITS (ADVISORY)

The three drawings in appendix B illustrate typical platform stabilization systems which are addressed in the standard. The drawings are to be used for reference purposes only, and do not illustrate all the mandatory requirements for each system.

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Typ al Se Pow ed Pl form--Cont nuous Ex er
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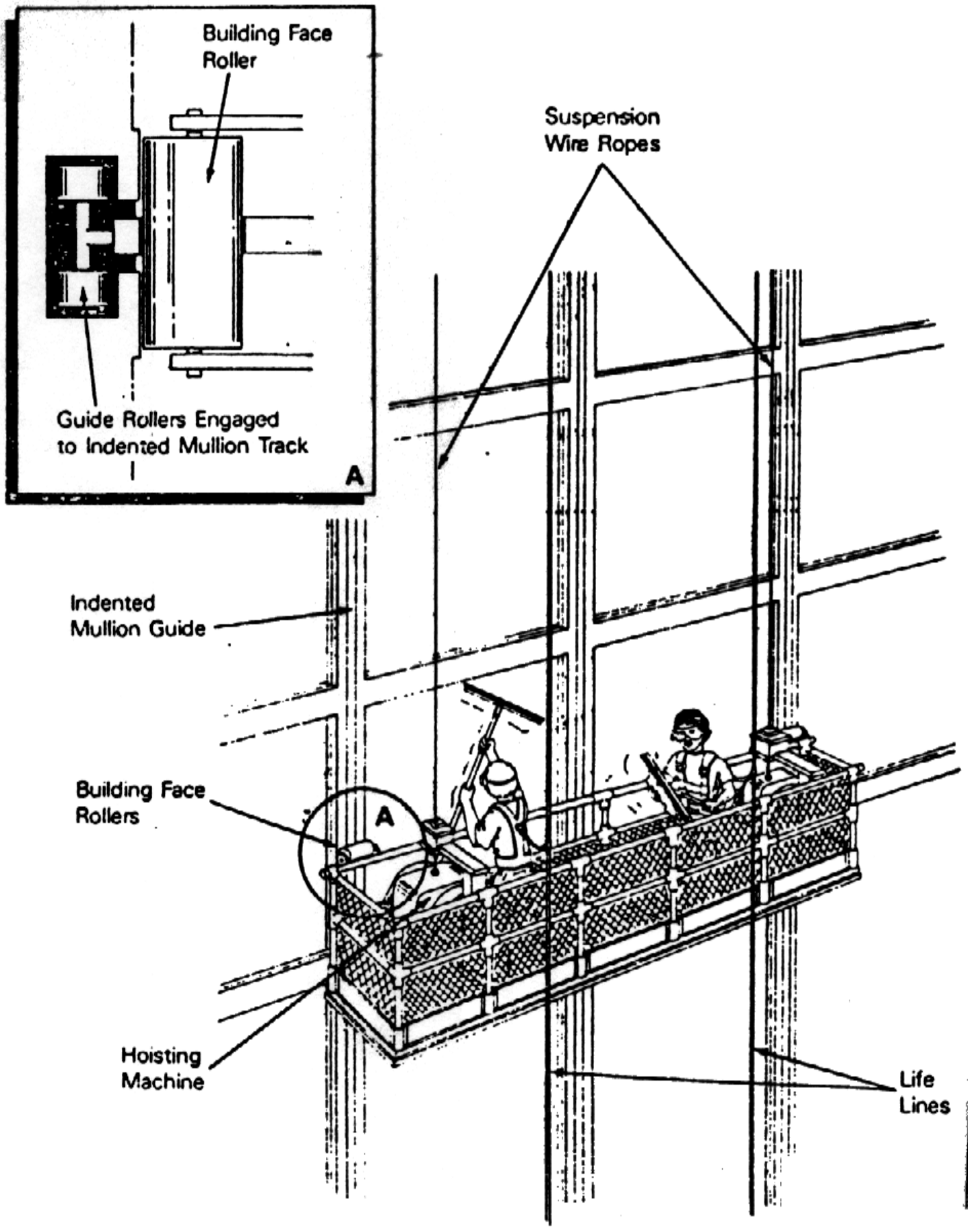


Figure 2

Typical Self-Powered Platform--Intermittent Tie-In System

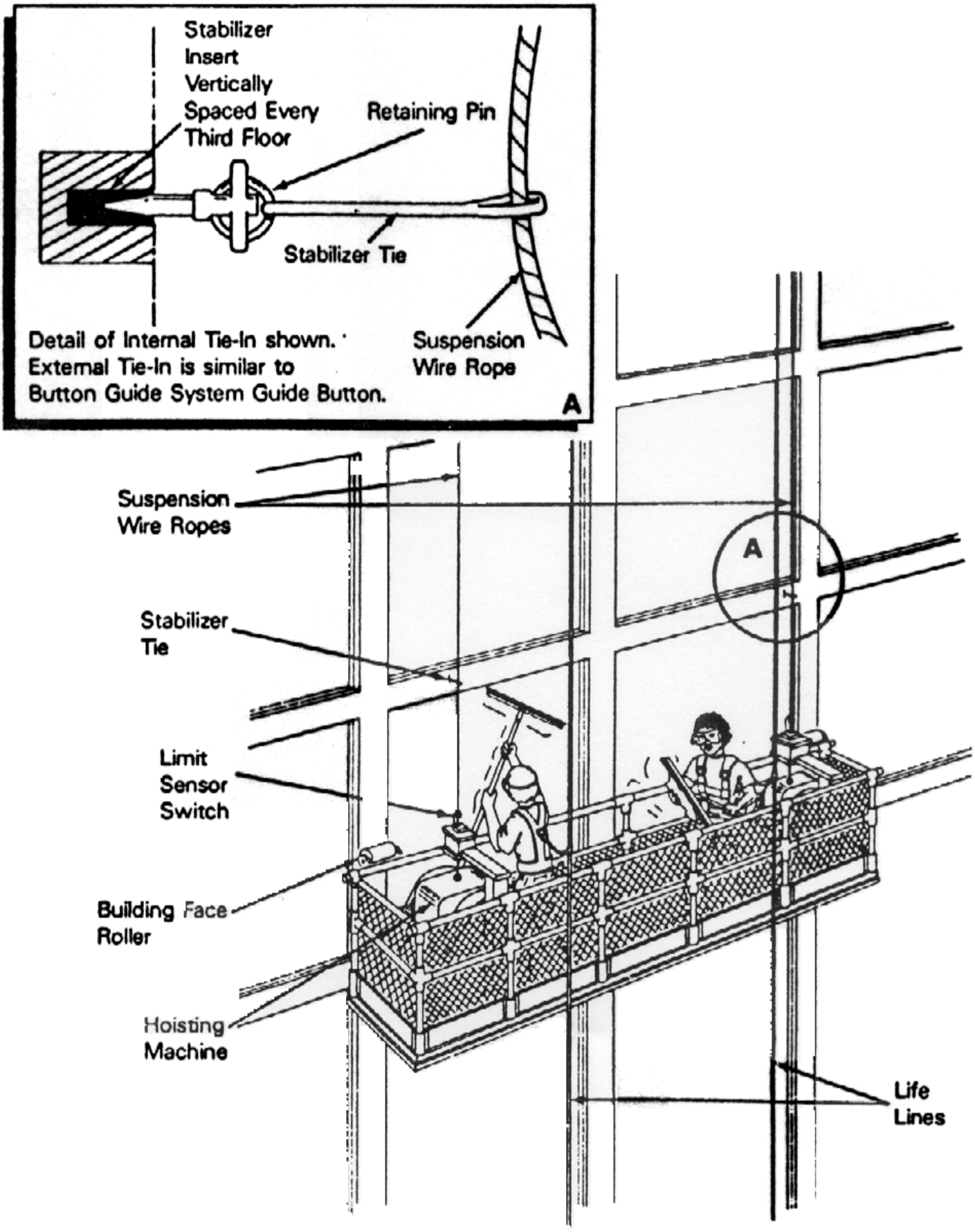
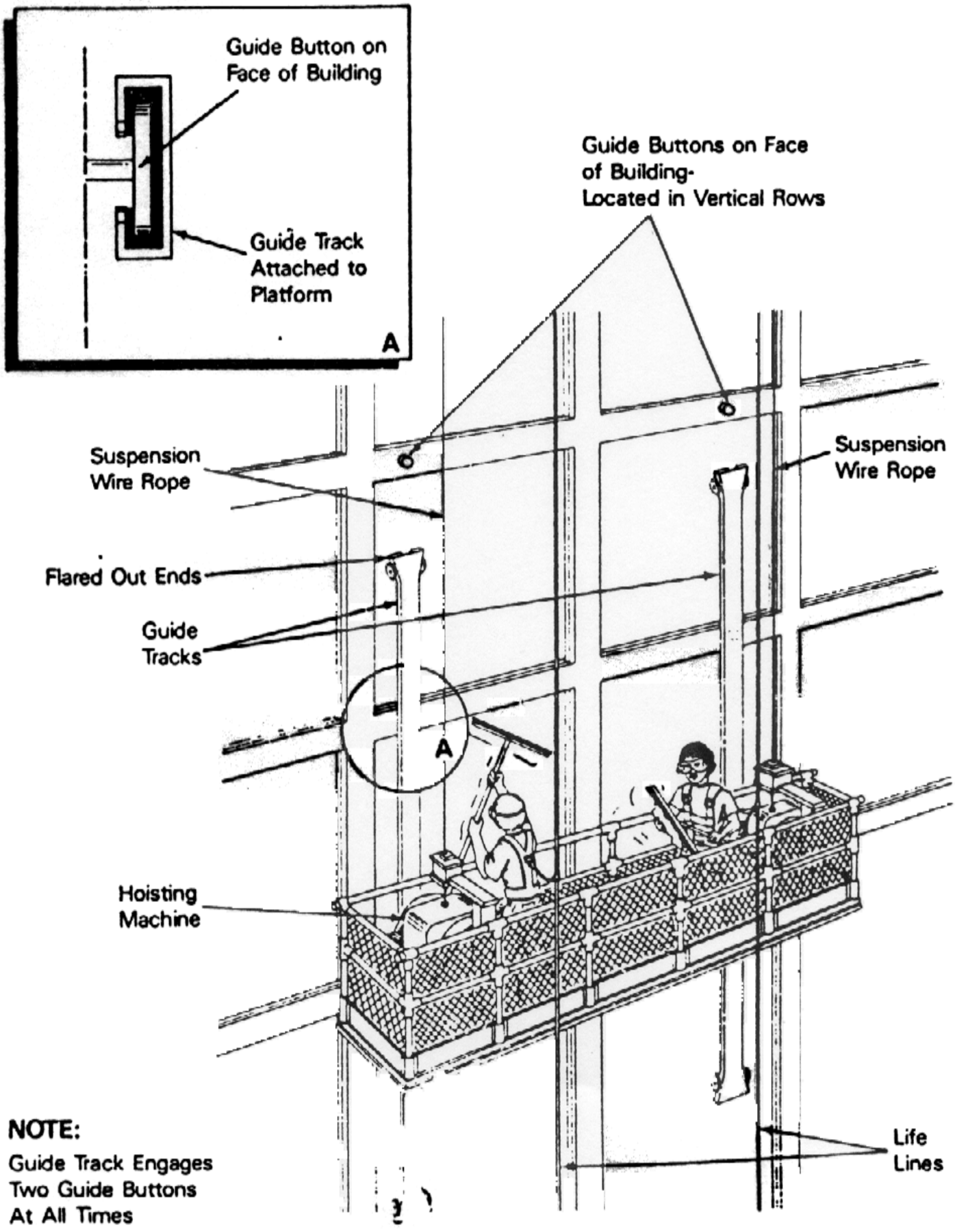


Figure 3

Typical Self-Powered Platform--Button Guide System



Appendix C
PERSONAL FALL ARREST SYSTEM (SECTION I--MANDATORY; SECTIONS II AND III--NON-MANDATORY)

Use of the Appendix

Section I of appendix C sets out the mandatory criteria for personal fall arrest systems used by all employees using powered platforms, as required by section 12-83-2(i). Section II sets out nonmandatory test procedures which may be used to determine compliance with applicable requirements contained in section I of this appendix. Section III provides nonmandatory guidelines which are intended to assist employers in complying with these provisions.

I. Personal fall arrest systems.

(a) Scope and application. This section establishes the application of and performance criteria for personal fall arrest systems which are required for use by all employees using powered platforms under subsection (i).

(b) Definitions.

"Anchorage" means a secure point of attachment for lifelines, lanyards, or deceleration devices, and which is independent of the means of supporting or suspending the employee.

"Body belt" means a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

"Body harness" means a design of straps which may be secured about the employee in a manner to distribute the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with means for attaching it to other components of a personal fall arrest system.

"Buckle" means any device for holding the body belt or body harness closed around the employee's body.

"Competent person" means a person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as in their application and use with related equipment.

"Connector" means a device which is used to couple (connect) parts of the system together. It may be an independent component of the system (such as a carabiner), or an integral component of part of the system (such as a buckle or dee-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

"Deceleration device" means any mechanism, such as a rope

grab, ripstitch lanyard, specially woven lanyard, tearing or deforming lanyard, or automatic self retracting-lifeline/lanyard, which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.

"Deceleration distance" means the additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.

"Equivalent" means alternative designs, materials, or methods which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials, or designs specified in the standard.

"Free fall" means the act of falling before the personal fall arrest system begins to apply force to arrest the fall.

"Free fall distance" means the vertical displacement of the fall arrest attachment point on the employee's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, lifeline, and lanyard elongation but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

"Lanyard" means a flexible line of rope, wire rope, or strap which is used to secure the body belt or body harness to a deceleration device, lifeline, or anchorage.

"Lifeline" means a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

"Personal fall arrest system" means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt, or body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these.

"Qualified person" means one with a recognized degree or

professional certificate and extensive knowledge and experience in the subject field who is capable of design, analysis, evaluation and specifications in the subject work, project, or product.

"Rope grab" means a deceleration device which travels on a lifeline and automatically frictionally engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/lever locking, or both.

"Self-retracting lifeline/lanyard" means a deceleration device which contains a drum-wound line which may be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

"Snap-hook" means a connector comprised of a hookshaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snap-hooks are generally one of two types:

(1) The locking type with a self-closing, self-locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection; or

(2) The non-locking type with a self-closing keeper which remains closed until pressed open for connection or disconnection.

"Tie-off" means the act of an employee, wearing personal fall protection equipment, connecting directly or indirectly to an anchorage. It also means the condition of an employee being connected to an anchorage.

(c) Design for system components.

(1) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(2) Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

(3) Lanyards and vertical lifelines which tie-off one employee shall have a minimum breaking strength of 5,000 pounds (22.2 kN).

(4) Self-retracting lifelines and lanyards which automatically limit free fall distance to two feet (0.61 m) or less shall have components capable of sustaining a minimum static tensile load of 3,000 pounds (13.3 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(5) Self-retracting lifelines and lanyards which do not

limit free fall distance to two feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(6) Dee-rings and snap hooks shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN).

(7) Dee-rings and snap-hooks shall be 100 per cent proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(8) Snap-hooks shall be sized to be compatible with the member to which they are connected so as to prevent unintentional disengagement of the snap-hook by depression of the snap-hook keeper by the connected member, or shall be a locking type snap-hook designed and used to prevent disengagement of the snap-hook by the contact of the snap-hook keeper by the connected member.

(9) Horizontal lifelines, where used, shall be designed, and installed as part of a complete personal fall arrest system, which maintains a safety factor of at least two, under the supervision of a qualified person.

(10) Anchorages to which personal fall arrest equipment is attached shall be capable of supporting at least 5,000 pounds (22.2 kN) per employee attached, or shall be designed, installed, and used as part of a complete personal fall arrest system which maintains a safety factor of at least two, under the supervision of a qualified person.

(11) Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses, shall be made from synthetic fibers or wire rope.

(d) System performance criteria.

(1) Personal fall arrest systems shall, when stopping a fall:

(i) Limit maximum arresting force on an employee to 900 pounds (4 kN) when used with a body belt;

(ii) Limit maximum arresting force on an employee to 1,800 pounds (8 kN) when used with a body harness;

(iii) Bring an employee to a complete stop and limit maximum deceleration distance an employee

travels to 3.5 feet (1.07 m); and

(iv) Shall have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of six feet (1.8 m), or the free fall distance permitted by the system, whichever is less.

(2) (i) When used by employees having a combined person and tool weight of less than 310 pounds (140 kg), personal fall arrest systems which meet the criteria and protocols contained in paragraphs (b), (c), and (d) in Section II of this appendix shall be considered as complying with the provisions of paragraphs (d)(1)(i) through (d)(1)(iv) of this appendix.

(ii) When used by employees having a combined tool and body weight of 310 pounds (140 kg) or more, personal fall arrest systems which meet the criteria and protocols contained in paragraphs (b), (c), and (d) in Section II may be considered as complying with the provisions of paragraphs (d)(1)(i) through (d)(1)(iv) provided that the criteria and protocols are modified appropriately to provide proper protection for such heavier weights.

(e) Care and use.

(1) Snap-hooks, unless of a locking type designed and used to prevent disengagement from the following connections, shall not be engaged:

(i) Directly to webbing, rope, or wire rope;

(ii) To each other;

(iii) To a dee-ring to which another snap-hook or other connector is attached;

(iv) To a horizontal lifeline; or

(v) To any object which is incompatibly shaped or dimensioned in relation to the snap-hook such that the connected object could repress the snap-hook keeper a sufficient amount to release itself.

(2) Devices used to connect to a horizontal lifeline which may become a vertical lifeline shall be capable of locking in either direction on the lifeline.

(3) Personal fall arrest systems shall be rigged such that an employee can neither free fall more than six feet (1.8 m), nor contact any lower level.

(4) The attachment point of the body belt shall be located in the center of the wearer's back. The attachment point of the body harness shall be located

in the center of the wearer's back near shoulder level, or above the wearer's head.

(5) When vertical lifelines are used, each employee shall be provided with a separate lifeline.

(6) Personal fall arrest systems or components shall be used only for employee fall protection.

(7) Personal fall arrest systems or components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection unless inspected and determined by a competent person to be undamaged and suitable for reuse.

(8) The employer shall provide for prompt rescue of employees in the event of a fall or shall assure the self-rescue capability of employees.

(9) Before using a personal fall arrest system, and after any component or system is changed, employees shall be trained in accordance with the requirements of section 12-83-2(h)(1)(A) through (E), in the safe use of the system.

(f) Inspections. Personal fall arrest systems shall be inspected prior to each use for mildew, wear, damage and other deterioration, and defective components shall be removed from service if their strength or function may be adversely affected.

II. Test methods for personal fall arrest systems (non-mandatory).

(a) General. Paragraphs (b), (c), (d), and (e), of Section II set forth test procedures which may be used to determined compliance with the requirements in paragraph (d)(1)(i) through (d)(1)(iv) of Section I of this appendix.

(b) General conditions for all tests in Section II.

(1) Lifelines, lanyards, and deceleration devices should be attached to an anchorage and connected to the body belt or body harness in the same manner as they would be when used to protect employees.

(2) The anchorage should be rigid, and should not have a deflection greater than .04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.

(3) The frequency response of the load measuring instrumentation should be 120 Hz.

(4) The test weight used in the strength and force tests should be a rigid, metal, cylindrical, or torso-shaped object with girth of 38 inches plus or minus four inches (96 cm plus or minus 10 cm).

(5) The lanyard or lifeline used to create the free fall distance should be supplied with the system, or in its absence, the least elastic lanyard or lifeline

available to be used with the system.

(6) The test weight for each test should be hoisted to the required level and should be quickly released without having any appreciable motion imparted to it.

(7) The system's performance should be evaluated taking into account the range of environmental conditions for which it is designed to be used.

(8) Following the test, the system need not be capable of further operation.

(c) Strength test.

(1) During the testing of all systems, a test weight of 300 pounds plus or minus five pounds (135 kg plus or minus 2.5 kg) should be used. (See paragraph (b)(4), above.)

(2) The test consists of dropping the test weight once. A new unused system should be used for each test.

(3) For lanyard systems, the lanyard length should be six feet plus or minus two inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body belt or body harness.

(4) For rope-grab-type deceleration systems, the length of the lifeline above the centerline of the grabbing mechanism to the lifeline's anchorage point should not exceed two feet (0.61 m).

(5) For lanyard systems, for systems with deceleration devices which do not automatically limit free fall distance to two feet (0.61 m) or less, and for systems with deceleration devices which have a connection distance in excess of one foot (0.3 m) (measured between the centerline of the lifeline and the attachment point to the body belt or harness), the test weight should be rigged to free fall a distance of 7.5 feet (2.3 m) from a point that is 1.5 feet (46 cm) above the anchorage point, to its hanging location (six feet below the anchorage). The test weight should fall without interference, obstruction, or hitting the floor or ground during the test. In some cases a non-elastic wire lanyard of sufficient length may need to be added to the system (for test purposes) to create the necessary free fall distance.

(6) For deceleration device systems with integral lifelines or lanyards which automatically limit free fall distance to two feet (0.61 m) or less, the test weight should be rigged to free fall a distance of four feet (1.22 m).

(7) Any weight which detaches from the belt or harness

should constitute failure for the strength test.

(d) Force test.

(1) General. The test consists of dropping the respective test weight specified below in (d)(2)(i) or (d)(3)(i) once. A new, unused system should be used for each test.

(2) For lanyard systems.

(i) A test weight of 220 pounds plus or minus three pounds (100 kg plus or minus 1.6 kg) should be used. (See paragraph (b)(4), above.)

(ii) Lanyard length should be six feet plus or minus two inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body belt or body harness.

(iii) The test weight should fall free from the anchorage level to its hanging location (a total of six feet (1.83 m) free fall distance) without interference, obstruction, or hitting the floor or ground during the test.

(3) For all other systems.

(i) A test weight of 220 pounds plus or minus three pounds (100 kg plus or minus 1.6 kg) should be used. (See paragraph (b)(4), above.)

(ii) The free fall distance to be used in the test should be the maximum fall distance physically permitted by the system during normal use conditions, up to a maximum free fall distance for the test weight of six feet (1.83 m), except as follows:

(A) For deceleration systems which have a connection link or lanyard, the test weight should free fall a distance equal to the connection distance (measured between the centerline of the lifeline and the attachment point to the body belt or harness).

(B) For deceleration device systems with integral lifelines or lanyards which automatically limit free fall distance to two feet (0.61 m) or less, the test weight should free fall a distance equal to that permitted by the system in normal use. (For example, to test a system with a self-retracting lifeline or lanyard, the test weight should be supported and the system allowed to retract the lifeline or lanyard as it would in normal use. The

test weight would then be released and the force and deceleration distance measured).

(4) A system fails the force test if the recorded maximum arresting force exceeds 1,260 pounds (15.6 kN) when using a body belt, and/or exceeds 2,520 pounds (11.2 kN) when using a body harness.

(5) The maximum elongation and deceleration distance should be recorded during the force test.

(e) Deceleration device tests.

(1) General. The device should be evaluated or tested under the environmental conditions, (such as rain, ice, grease, dirt, type of lifeline, etc.), for which the device is designed.

(2) Rope-grab-type deceleration devices.

(i) Devices should be moved on a lifeline 1,000 times over the same length of line a distance of not less than one foot (30.5 cm), and the mechanism should lock each time.

(ii) Unless the device is permanently marked to indicate the type(s) of lifeline which must be used, several types (different diameters and different materials), of lifelines should be used to test the device.

(3) Other self-activating-type deceleration devices. The locking mechanisms of other self-activating-type deceleration devices designed for more than one arrest should lock each of 1,000 times as they would in normal service.

III. Additional non-mandatory guidelines for personal fall arrest systems.

The following information constitutes additional guidelines for use in complying with requirements for a personal fall arrest system.

(a) Selection and use considerations. The kind of personal fall arrest system selected should match the particular work situation, and any possible free fall distance should be kept to a minimum. Consideration should be given to the particular work environment. For example, the presence of acids, dirt, moisture, oil, grease, etc., and their effect on the system, should be evaluated. Hot or cold environments may also have an adverse affect on the system. Wire rope should not be used where an electrical hazard is anticipated. As required by the standard, the employer must plan to have means available to promptly rescue an employee should a fall occur, since the suspended employee may not be able to reach a work level independently.

Where lanyards, connectors, and lifelines are subject to damage by work operations such as welding, chemical cleaning, and sandblasting, the component should be protected, or other securing systems should be used. The employer should fully evaluate the work conditions and environment (including seasonal weather changes) before selecting the appropriate personal fall protection system. Once in use, the system's effectiveness should be monitored. In some cases, a program for cleaning and maintenance of the system may be necessary.

(b) Testing considerations. Before purchasing or putting into use a personal fall arrest system, an employer should obtain from the supplier information about the system based on its performance during testing so that the employer can know if the system meets this standard. Testing should be done using recognized test methods. Section II of this appendix C contains test methods recognized for evaluating the performance of fall arrest systems. Not all systems may need to be individually tested; the performance of some systems may be based on data and calculations derived from testing of similar systems, provided that enough information is available to demonstrate similarity of function and design.

(c) Component compatibility considerations. Ideally, a personal fall arrest system is designed, tested, and supplied as a complete system. However, it is common practice for lanyards, connectors, lifelines, deceleration devices, body belts and body harnesses to be interchanged since some components wear out before others. The employer and employee should realize that not all components are interchangeable. For instance, a lanyard should not be connected between a body belt (or harness) and a deceleration device of the self-retracting type since this can result in additional free fall for which the system was not designed. Any substitution or change to a personal fall arrest system should be fully evaluated or tested by a competent person to determine that it meets the standard, before the modified system is put in use.

(d) Employee training considerations. Thorough employee training in the selection and use of personal fall arrest systems is imperative. As stated in the standard, before the equipment is used, employees must be trained in the safe use of the system. This should include the following: Application limits; proper anchoring and tie-off techniques; estimation of free fall distance, including determination of deceleration distance, and total fall distance to prevent striking a lower level;

methods of use; and inspection and storage of the system. Careless or improper use of the equipment can result in serious injury or death. Employers and employees should become familiar with the material in this appendix, as well as manufacturer's recommendations, before a system is used. Of uppermost importance is the reduction in strength caused by certain tie-offs (such as using knots, tying around sharp edges, etc.) and maximum permitted free fall distance. Also, to be stressed are the importance of inspections prior to use, the limitations of the equipment, and unique conditions at the worksite which may be important in determining the type of system to use.

(e) Instruction considerations. Employers should obtain comprehensive instructions from the supplier as to the system's proper use and application, including, where applicable:

(1) The force measured during the sample force test;
(2) The maximum elongation measured from lanyards during the force test;
(3) The deceleration distance measured for deceleration devices during the force test;
(4) Caution statements on critical use limitations;
(5) Application limits;
(6) Proper hook-up, anchoring, and tie-off techniques, including the proper dee-ring or other attachment point to use on the body belt and harness for fall arrest;
(7) Proper climbing techniques;
(8) Methods of inspection, use, cleaning, and storage; and
(9) Specific lifelines which may be used. This information should be provided to employees during training.

(f) Inspection considerations. As stated in Section I, paragraph (f) of this appendix, personal fall arrest systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

(g) Rescue considerations. As required by Section I, subsection (d)(9) of this appendix, when personal fall

arrest systems are used, the employer must assure that employees can be promptly rescued or can rescue themselves should a fall occur. The availability of rescue personnel, ladders or other rescue equipment should be evaluated. In some situations, equipment which allows employees to rescue themselves after the fall has been arrested may be desirable, such as devices which have descent capability.

(h) Tie-off considerations.

(1) One of the most important aspects of personal fall protection systems is fully planning the system before it is put into use. Probably the most overlooked component is planning for suitable anchorage points. Such planning should ideally be done before the structure or building is constructed so that anchorage points can be incorporated during construction for use later for window cleaning or other building maintenance. If properly planned, these anchorage points may be used during construction, as well as afterwards.

(2) Employers and employees should at all times be aware that the strength of a personal fall arrest system is based on its being attached to an anchoring system which does not significantly reduce the strength of the system (such as a properly dimensioned eye-bolt/snap-hook anchorage). Therefore, if a means of attachment is used that will reduce the strength of the system, that component should be replaced by a stronger one, but one that will also maintain the appropriate maximum arrest force characteristics.

(3) Tie-off using a knot in a rope lanyard or lifeline (at any location) can reduce the lifeline or lanyard strength by 50 per cent or more. Therefore, a stronger lanyard or lifeline should be used to compensate for the weakening effect of the knot, or the lanyard length should be reduced (or the tie-off location raised) to minimize free fall distance, or the lanyard or lifeline should be replaced by one which has an appropriately incorporated connector to eliminate the need for a knot.

(4) Tie-off of a rope lanyard or lifeline around and "H" or "I" beam or similar support can reduce its strength as much as 70 per cent due to the cutting action of the beam edges. Therefore, use should be made of a webbing lanyard or wire core lifeline around the beam; or the lanyard or lifeline should be protected from the edge; or free fall distance should

be greatly minimized.

(5) Tie-off where the line passes over or around rough or sharp surfaces reduces strength drastically. Such a tie-off should be avoided or an alternative tie-off rigging should be used. Such alternatives may include use of a snap-hook/dee-ring connection, wire rope tie-off, an effective padding of the surfaces, or an abrasion-resistance strap around or over the problem surface.

(6) Horizontal lifelines may, depending on their geometry and angle of sag, be subjected to greater loads than the impact load imposed by an attached component. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. The reason for this is that in multiple tie-offs to a horizontal lifeline, if one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to also fall. Horizontal lifeline and anchorage strength should be increased for each additional employee to be tied-off. For these and other reasons, the design of systems using horizontal lifelines must only be done by qualified persons. Testing of installed lifelines and anchors prior to use is recommended.

(7) The strength of an eye-bolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at an angle to this axis (in the direction of shear). Also, care should be exercised in selecting the proper diameter of the eye to avoid accidental disengagement of snap-hooks not designed to be compatible for the connection.

(8) Due to the significant reduction in the strength of the lifeline/lanyard (in some cases, as much as a 70 per cent reduction), the sliding hitch knot should not be used for lifeline/lanyard connections except in emergency situations where no other available system is practical. The "one-and-one" sliding hitch

knot should never be used because it is unreliable in stopping a fall. The "two-and-two", or "three-and-three" knot (preferable), may be used in emergency situations; however, care should be taken to limit free fall distance to a minimum because of reduced lifeline/lanyard strength.

(i) Vertical lifeline considerations. As required by the standard, each employee must have a separate lifeline when the lifeline is vertical. The reason for this is that in multiple tie-offs to a single lifeline, if one employee falls, the movement of the lifeline during the arrest of the fall may pull other employees' lanyards, causing them to fall as well.

(j) Snap-hook considerations. Although not required by this standard for all connections, locking snap-hooks designed for connection to suitable objects (of sufficient strength) are highly recommended in lieu of the non-locking type. Locking snap-hooks incorporate a positive locking mechanism in addition to the spring loaded keeper, which will not allow the keeper to open under moderate pressure without someone first releasing the mechanism. Such a feature, properly designed, effectively prevents roll-out from occurring.

As required by the Section I subsection (d)(1) of this appendix, the following connections must be avoided (unless properly designed locking snap-hooks are used) because they are conditions which can result in roll-out when a nonlocking snap-hook is used:

(1) Direct connection of a snap-hook to a horizontal lifeline;
(2) Two (or more) snap-hooks connected to one dee-ring;
(3) Two snap-hooks connected to each other;
(4) A snap-hook connected back on its integral lanyard; and
(5) Improper dimensions of the dee-ring, rebar, or other connection point in relation to the snap-hook dimensions which would allow the snap-hook keeper to be depressed by a turning motion of the snap-hook.

(k) Free fall considerations. The employer and employee should at all times be aware that a system's maximum arresting force is evaluated under normal use conditions established by the manufacturer, and in no case using a free fall distance in excess of six feet (1.8 m). A few extra feet of free fall can significantly increase the arresting force on the employee, possibly to the point of causing injury. Because of this, the free fall distance

should be kept at a minimum, and, as required by the standard, in no case greater than six feet (1.8 m). To help assure this, the tie-off attachment point to the lifeline or anchor should be located at or above the connection point of the fall arrest equipment to belt or harness. (Since otherwise additional free fall distance is added to the length of the connecting means i.e. lanyard). Attaching to the working surface will often result in a free all greater than six feet (1.8 m). For instance, if a six foot (1.8 m) lanyard is used, the total free fall distance will be the distance from the working level to the body belt (or harness) attachment point plus the six feet (1.8 m) of lanyard length. Another important consideration is that the arresting force which the fall system must withstand also goes up with greater distances of free fall possibly exceeding the strength of the system.

(l) Elongation and deceleration distance considerations. Other factors involved in a proper tie-off are elongation and deceleration distance. During the arresting of a fall, a lanyard will experience a length of stretching or elongation, whereas activation of a deceleration device will result in a certain stopping distance. These distances should be available with the lanyard or device's instructions and must be added to the free fall distance to arrive at the total fall distance before an employee is fully stopped. The additional stopping distance may be very significant if the lanyard or deceleration device is attached near or at the end of a long lifeline, which may itself add considerable distance due to its own elongation. As required by the standard, sufficient distance to allow for all of these factors must also be maintained between the employee and obstruction below, to prevent an injury due to impact before the system fully arrests the fall. In addition, a minimum of 12 feet (3.7 m) of lifeline should be allowed below the securing point of a rope grab type deceleration device, and the end terminated to prevent the device from sliding off the lifeline. Alternatively, the lifeline should extend to the ground or the next working level below. These measures are suggested to prevent the worker from inadvertently moving past the end of the lifeline and having the rope grab become disengaged from the lifeline.

(m) Obstruction considerations. The location of the tie-off should also consider the hazard of obstructions in the potential fall path of the employee. Tie-offs which minimize the possibilities of exaggerated swinging should

be considered. In addition, when a body belt is used, the employee's body will go through a horizontal position to a jack-knifed position during the arrest of all falls. Thus, obstructions which might interfere with this motion should be avoided or a severe injury could occur.

(n) Other considerations. Because of the design of some personal fall arrest systems, additional considerations may be required for proper tie-off. For example, heavy deceleration devices of the self-retracting type should be secured overhead in order to avoid the weight of the device having to be supported by the employee. Also, if self-retracting equipment is connected to a horizontal lifeline, the sag in the lifeline should be minimized to prevent the device from sliding down the lifeline to a position which creates a swing hazard during fall arrest. In all cases, manufacturer's instructions should be followed.

Appendix D

EXISTING INSTALLATIONS (MANDATORY)

Use of the Appendix

Appendix D sets out the mandatory building and equipment requirements for applicable permanent installations completed after August 27, 1971, and no later than July 23, 1990 which are exempt from the paragraphs (a), (b)(1), (b)(2), (c), (d), (e), and (f) of this standard. The requirements in appendix D are essentially the same as unrevised building and equipment provisions which previously were designated as section 12-83-2(a), (b), (c), and (d) and which were effective July 11, 1974.

Note: All existing installations subject to this appendix shall also comply with paragraphs (f), (g), (h), (i), and appendix C of section 12-83-2.

Definitions

"ANSI A12.1" means ANSI A12.1-1973, Safety Requirements for Floor and Wall Openings, Railings and Toeboard.

"ANSI A120.1" means ANSI A120.1-1970, Safety Requirements for Powered Platforms for Exterior Building Maintenance.

"Angulating roping" means a system of platform suspension in which the upper wire rope sheaves or suspension points are closer to the plane of the building face than the corresponding attachment points on the platform, thus causing the platform to press against the face of the building during its vertical travel.

"Babitted fastening" means the method of providing wire rope attachments in which the ends of the wire strands are bent back and held in a tapered socket by means of poured molten babbit metal.

"Brake--disc type" means a brake in which the holding effect is obtained by frictional resistance between one or more faces of discs keyed to the rotating member to be held, and fixed discs keyed to the stationary or housing member (pressure between the discs being applied axially).

"Brake--self-energizing band type" means an essentially unidirectional brake in which the holding effect is obtained by the snubbing action of a flexible band grappled about a cylindrical wheel or drum affixed to the rotating member to be held, the connections and linkage being so arranged that the motion of the brake wheel or drum will act to increase the tension or holding force of the band.

"Brake--shoe type" means a brake in which the holding effect is obtained by applying the direct pressure of 2 or more segmental

friction elements held to a stationary member against a cylindrical wheel or drum affixed to the rotating member to be held.

"Building face roller" means a specialized form of guide roller designed to contact a portion of the outer face or wall structure of the building, and to assist in stabilizing the operators' platform during vertical travel.

"Continuous pressure" means operation by means of buttons or switches, any one of which may be used to control the movement of the working platform or roof car, only as long as the button or switch is manually maintained in the actuating position.

"Control" means a system governing starting, stopping, direction, acceleration, speed, and retardation of moving members.

"Controller" means a device or group of devices, usually contained in a single enclosure, which serves to control in some predetermined manner the apparatus to which it is connected.

"Electrical ground" means a conducting connection between an electrical circuit or equipment and the earth, or some conducting body which serves in place of the earth.

"Guide roller" means a rotating, bearing-mounted, generally cylindrical member, operating separately or as part of a guide shoe assembly, attached to the platform, and providing rolling contact with building guideways, or other building contact members.

"Guide shoe" means an assembly of rollers or slide members, or the equivalent, attached as a unit to the operators' platform and designed to engage with the building members provided for the vertical guidance of the operators' platform.

"Interlock" means a device actuated by the operation of some other device with which it is directly associated, to govern succeeding operations of the same or allied devices.

"NFPA" means National Fire Protection Association.

"NFPA 70" means NFPA 70-81, National Electric Code.

"Operating device" means a pushbutton or lever, or any other manual device used to actuate a control.

"Powered platform" means equipment to provide access to the exterior of a building for maintenance, consisting of a suspended power-operated working platform, a roof car or other suspension means, and the requisite operating and control devices.

"Rated load" means the combined weight of employees, tools, equipment, and other material which the working platform is designed and installed to lift.

"Relay, direction" means an electrically energized contractor responsive to an initiating control circuit, which in turn causes a moving member to travel in a particular direction.

"Relay, potential for vertical travel" means an electrically energized contactor responsive to initiating control circuit, which in turn controls the operation of a moving member in both directions; this relay usually operates in conjunction with direction relays, as

described under the definition "relay, direction".

"Roof car" means a structure for the suspension of a working platform, providing for its horizontal movement to working positions.

"Roof-powered platform" means a powered platform having the raising and lowering mechanism located on a roof car.

"Self-powered platform" means a powered platform having the raising and lowering mechanism located on the working platform.

"Telescopic derricks" means extensible boom platforms when the derricks are used with personnel platforms.

"Traveling cable" means a cable made up of electrical or communication conductors, or both, and providing electrical connection between the working platform and the roof car or any other fixed point.

"Weatherproof" means equipment so constructed or protected that exposure to the weather will not interfere with its proper operation.

"Working platform" means the suspended structure arranged for vertical travel which provides access to the exterior of the building or structure.

"Yield point" means the stress at which the material exhibits a permanent set of 0.2 per cent.

"Zinced fastenings" means the method of providing wire rope attachments in which the splayed or fanned wire ends are held in a tapered socket by means of poured molten zinc.

Powered platforms for exterior building maintenance

(a) General requirements.

(1) This appendix establishes safety requirements for the design, construction, installation, operation, maintenance, inspection, and use of power-operated platforms for exterior building maintenance. The requirements of this appendix do not apply to temporary equipment used for construction work or to devices which are raised and lowered manually. The purpose of this standard is to provide for the safety of life and limb of users of exterior powered platforms, as well as of others who may be exposed. The equipment described in this appendix is intended for use by one or more workers who are engaged in exterior work, such as window cleaning, caulking, metal-polishing, and general exterior building maintenance or repairs.

(2) This appendix applies to all powered platforms installed subsequent to December 6, 1982, with the exception of powered platforms installed for emergency purposes.

(3) All new powered platforms for exterior building maintenance purchased and used after December 6, 1982 but

before July 23, 1990, shall meet all of the design, construction, installation, and maintenance requirements of parts II and III of ANSI A120.1 and of this section. Reference shall be made to appropriate parts of ANSI A120.1 for detail specifications for equipment and special installations.

(4) The requirements of this appendix apply only to electric powered platforms. It is not the intent of this appendix to prohibit the use of other types of power. Installation of powered platforms using other types of power is permitted, provided the platforms have adequate protective devices for the type of power used, and otherwise provide for reasonable safety of life and limb to users of equipment and to others who may be exposed.

(5) For the purpose of applying this standard, powered platforms are divided into 2 basic types, types F and T.

(A) Powered platforms designated as type F shall meet all of the requirements of paragraph (3) above. A basic requirement of type F equipment is that the working platform is suspended by at least 4 wire ropes and designed so that failure of any one wire rope will not substantially alter the normal position of the working platform. Another basic requirement of type F equipment is that only one layer of hoisting rope is permitted on winding drums. Type F powered platforms may be either roof-powered or self-powered.

(B) Powered platforms designated as type T shall meet all the requirements of paragraph (3) above. A basic requirement of type T equipment is that the working platform is suspended by at least 2 wire ropes. Failure of one wire rope would not permit the working platform to fall to the ground, but would upset its normal position. The employer shall require employees working on type T equipment to wear safety belts, which are attached by lanyards to lifeline grabs. Type T powered platform may be either roof--powered or self-powered.

(C) The requirements of this appendix apply to powered platforms with winding drum type hoisting machines. It is not the intent of this appendix to prohibit powered platforms using other types of hoisting machines such as, but not limited to, traction drum hoisting machines, air powered machines, hydraulic powered machines, and internal combustion machines. Installation of powered platforms with other types of hoisting machines is permitted, provided adequate protective devices are used, and provided reasonable

safety of life and limb to users of the equipment and to others who may be exposed is ensured.

(6) The following requirements for intermittent tie-in stabilization systems shall apply wherever building face guides, required by paragraph (3) above, are not installed for window washing operations and light building maintenance, and shall take precedence over applicable portions of chapter 12-96 (Window Cleaning) as exceptions allowed for new development under section 12-96-2. These requirements shall not apply to two-point suspension scaffolds. The building anchor system shall be installed in the following manner:

(A) The building anchors shall be located in vertical rows, with an attachment of maximum elevation at every third floor, approximately 45 feet, and spaced horizontally to allow a stabilization attachment for each of the 2 platform suspension wire ropes. The minimum tensile strength of the anchor bolt shall be 600 pounds.

(B) As the suspended platform descends past the elevation of each anchorage, each of the platform occupants shall secure a "quick connect-quick disconnect stabilizer-tie" between a suspension wire rope and a building anchor. Each stabilizer-tie shall contain an adjustable lanyard to allow positioning each suspension wire rope vertically at a predetermined angulation that shall provide at least 10 pounds of pressure against the building at the lowest point of the tie-in span. The process will be repeated as each elevation of tie-in anchorage is reached during the descent of the platform.

(C) This process shall be reversed (that is, the stabilizers shall be removed as each elevation of the stabilization tie-ins is reached) as the platform ascends. The removal is ensured in that the platform shall be provided with electrical interlocks to interrupt power to its hoists in the event either interlock contacts a stabilizer during the ascent of the platform.

(D) The intermittent stabilization system, including its building anchor, shall have a safety factor of 4 and the suspension wire ropes shall have a safety factor of 10 against failure.

(i) The platform shall be provided with a taut, 5/16-inch diameter, horizontal, galvanized, wire-rope static line secured to a structural member at both ends of the platform and at the

mid-point of the rear guardrail system so that each section of the wire rope static line acts as an independent wire rope lifeline to support either operator in case of a suspension rope failure. The configuration of the attachment shall be such that the combined loads of 2 persons shall not be exerted on any attachment at the same time in an emergency. The structural member for the attachment shall sustain a static load of at least 4,000 pounds.

(a) This powered platform (scaffold) shall not be used during any period of wind velocity above 25 miles per hour. An instrument which will accurately measure wind velocity shall be located on the roof of the building.

(b) The suspension rope angulation shall be designed into the suspension system and the tie-in lanyard so that the platform shall exert a minimum force of approximately 10 pounds against the face of the building.

(c) The platform floor shall have openings or gaps to facilitate upward air flow.

(d) The platform shall be no greater than 32 feet in length nor 3 feet in width.

(e) The platform shall also be equipped with building-face rollers.

(f) The platform shall be provided with a sensing device that will interrupt its power supply in the event that the platform contacts the tie-in lanyard assembly, to prevent further ascent, and ensure that the lanyard assembly can be disengaged from the building anchor.

(ii) The employer shall designate a safety monitor capable of identifying and correcting hazards associated with the intermittent tie-in system for powered platforms.

(a) The monitor shall be trained and capable of identifying existing and predictable conditions and actions, which are hazardous to employees utilizing the intermittent tie-in system. These hazardous conditions may involve platform and auxiliary equipment, building anchors, anemometer, personal protective equipment,

electrical systems, and communications. Employee actions that shall be monitored are adherence to established procedures, use of personal protective equipment, and radio communications with building management personnel.

(b) The monitor shall warn employees of hazardous conditions and unsafe actions on a roof or a powered platform, when it appears to the monitor that they are unaware of a hazard or are acting in an unsafe manner.

(c) The monitor shall be authorized to take prompt corrective action in eliminating hazardous conditions. The monitor shall report to the employer any hazardous conditions which were observed and corrected, and submit recommendations to the employer for any condition which needs future correction.

(d) The monitor shall be able to observe employees and be close enough to verbally communicate with them.

(iii) Each employee on the working platform of powered platforms shall be provided with and shall wear the following personal protective equipment:

(a) A body harness with a short lanyard and an automatic locking grab attached to a horizontal static line on the working platform. The locking grab shall have a minimum breaking strength of 4,000 pounds. The body harness, the lanyard, and other components, including fastening means and anchorages to the working platform, shall have a minimum breaking strength of 4,000 pounds. The attachment to the static line on the platform shall have a minimum breaking strength of 4,000 pounds suitable for one person; and

(b) Fastening devices on the lanyard shall be of the self-closing type, equipped with a double locking device to prevent accidental opening of the fastening device.

(E) Operators of powered platforms shall have the knowledge and training to operate equipment in

accordance with the manufacturer's recommendations and to perform all operations of the intermittent stabilization system.

(F) The employer shall ensure that all procedures required for the proper and safe functioning of the intermittent stabilization system are carried out.

(b) Type F powered platforms.

(1) Roof car.

(A) A roof car shall be provided whenever it is necessary to move the working platform horizontally to working or storage positions.

(B) The maximum rated speed at which a power traversed roof car may be moved in a horizontal direction shall be 50 feet per minute.

(2) Movement and positioning of roof car.

(A) Movement shall be restricted. Provision shall be made to protect against having the roof car leave the roof or enter roof areas not designed for travel.

(B) The horizontal motion of the roof cars shall be positively controlled so as to insure proper movement and positioning of the roof car.

(C) Roof car positioning devices shall be provided to insure that the working platform is placed and retained in proper position for vertical travel and during storage.

(D) Mechanical stops shall be provided to prevent the traversing of the roof car beyond its normal limits of travel. These stops shall be capable of withstanding a force equal to 100 per cent of the inertial effect of the roof car in motion with traversing power applied.

(E) The operating device of a power-operated roof car for traversing shall be located on the roof car or the working platform, or both, and shall be of the continuous pressure, weatherproof, electric type. If more than one operating device is provided, they shall be so arranged that traversing is possible only from one operating device at a time. The operating device shall be so connected that it is not operable until the working platform is located at its uppermost position of travel and is not in contact with the building face or fixed vertical guides in the face of the building and all protective devices and interlocks are in a position for traversing.

(3) Roof car stability shall be determined by either subparagraph (A) or (B) below, whichever is greater.

(A) The roof car shall be continuously stable,

considering overturning moment as determined by 125 per cent rated load, plus maximum dead load, and the prescribed wind loading.

(B) The roof car and its anchorages shall be capable of resisting accidental over-tensioning of the wire ropes suspending the working platform, and this calculated value shall include the effect of 1-1/2 times the value. For this calculation, the simultaneous effect of 1/2 wind load shall be included, and the design stresses shall not exceed those referred to in subsection (a)(3) above.

(C) If the load on the motors is at any time in excess of 3 times that required for lifting the working platform with its rated load, the motor shall stall.

(4) Safe access to the roof car and from the roof car to the working platform shall be provided. If the access to the roof car at any point of its travel is not over the roof area or where otherwise necessary for safety, self-closing and self-locking gates shall be provided. Applicable parts of ANSI A12.1 shall apply.

(5) Means shall be provided to run the roof car away from the roof perimeter, where necessary, and to provide a safe area for maintenance, repairs, and storage. Provisions shall be made to secure the machine in the stored position. For stored machines subject to wind forces, special design and anchorage requirements for "wind forces" in part II, section 10.5 of ANSI A120.1 shall be used.

(6) The working platform shall be of girder or truss construction and shall be adequate to support its rated load under any position of loading, and comply with subsection (a)(3) above.

(7) Each working platform shall bear a manufacturer's load rating plate which is conspicuously posted and which displays the maximum permissible rated load. Load rating plates shall be made of noncorrosive material and shall have letters and figures stamped, etched, or cast on the surface. The minimum height of the letters and figures shall be 1/4 inch.

(8) The working platform shall have a minimum net width of 24 inches.

(9) Working platforms shall be furnished with permanent guardrails not less than 36 inches high, and not more than 42 inches high at the front (building side). At the rear, and on the sides, the rail shall not be less than 42 inches high. An intermediate guardrail shall be provided around the entire platform between the top guardrail and

the toeboard.

(10) A 4-inch toeboard shall be provided along all sides of the working platform.

(11) The spaces between the intermediate guardrail and platform toeboard on the building side of the working platform, and between the top guardrail and the toeboard on other sides of the platform, shall be filled with metallic mesh or similar material that will reject a ball 1 inch in diameter. The installed mesh shall be capable of withstanding a load of over 100 pounds applied horizontally over any area of 144 square inches. If the space between the platform and the building face does not exceed 8 inches, and the platform is restrained by guides, the mesh may be omitted on the front side.

(12) The platform flooring shall be of the nonskid type and, if of open construction, shall reject a 9/16-inch diameter ball, or be provided with a screen below the floor to reject a 9/16-inch diameter ball.

(13) Where access gates are provided, they shall be self-closing and self-locking.

(14) Operating devices, for vertical movement of the working platform.

(A) The normal operating device for the working platform shall be located on the working platform and shall be of the continuous pressure, weatherproof, electric type.

(B) The operating device shall be operable only when all electrical protective devices and interlocks on the working platform are in position for normal service, and the roof car, if provided, is at an established operating point.

(15) Emergency electric operative device.

(A) In addition, on roof-powered platforms, an emergency electric operating device shall be provided near the hoisting machine for use in the event of failure of the normal operating device for the working platform, or failure of the traveling cable system. The emergency operating device shall be mounted in a locked compartment and shall have a legend mounted thereon reading: "For Emergency Operation Only. Establish Communication With Personnel on Working Platform Before Use."

(B) A key for unlocking the compartment housing the emergency operating device shall be mounted in a break-glass receptacle located near the emergency operating device.

(16) Emergency operation of the main drive machine may be

provided to allow manual cranking. This provision for manual operation shall be designed so that not more than 2 persons will be required to perform this operation. The access to this provision shall include a means to automatically make the machine inoperative electrically while under the emergency manual operation. The design shall be such that the emergency brake is operative at or below governor tripping speed during manual operation.

(17) Arrangement and guarding of hoisting equipment.

(A) Hoisting equipment shall consist of a power-driven drum or drum contained in the roof car (roof-powered platforms) or contained on the working platform (self-powered platform).

(B) The hoisting equipment shall be power-operated in both up and down directions.

(C) Guards or other protective devices shall be installed wherever rotating shafts or other mechanisms or gears may expose personnel to a hazard.

(D) Friction devices or clutches shall not be used for connecting the main driving mechanism to the drum or drums. Belt-driven or chain-driven machines shall not be used.

(18) Hoisting motors.

(A) Hoisting motors shall be electric and of weatherproof construction.

(B) Hoisting motors shall be in conformance with applicable parts of paragraph (21) below.

(C) Hoisting motors shall be directly connected to the hoisting machinery. Motor couplings, if used, shall be of steel construction.

(19) The hoisting machine shall have 2 independent braking means, each designed to stop and hold the working platform with 125 per cent of rated load.

(20) Hoisting ropes and rope connections.

(A) Working platforms shall be suspended by wire ropes of either 6 x 19 or 6 x 37 classification, preformed or nonpreformed.

(B) The minimum safety factor shall be 10, and shall be calculated by:

$$F = \frac{S \times N}{W}$$

where:

S = Manufacturer's rated breaking strength of one rope.

N = Number of ropes under load.

W = Maximum static load on all ropes with the platform and its rated load at any point of its travel.

(C) Hoisting ropes shall be sized to conform with the required factor safety, but in no case shall the size be less than 5/16-inch diameter.

(D) Winding drums shall have at least 3 turns of rope remaining when the platform has landed at the lowest possible point of its travel.

(E) Wire rope shall not be lengthened or repaired by joining 2 or more lengths of wire rope.

(F) The nondrum ends of the hoisting ropes shall be provided with individual shackle rods which will permit individual adjustment of rope lengths, if required.

(G) Each rope shall have no more than 2 reverse bends.

(21) Electrical wiring and equipment.

(A) All electrical equipment and wiring shall conform to the requirements of NFPA 70, except as modified by ANSI A120.1 which contains detailed design specifications for electrical equipment in part II.

(B) All motors and operation and control equipment shall be supplied from a single power source.

(C) The power supply for the powered platform shall be an independent circuit supplied through a fused disconnect switch.

(D) Electrical conductor parts of the power supply system shall be protected against accidental contact.

(E) Electrical grounding shall be provided.

(i) Means for electrical grounding shall be included with the power-supply system.

(ii) Controller cabinets, motor frames, hoisting machines, the working platform, roof car, and roof car track system, and noncurrent carrying parts of electrical equipment, where provided, shall be grounded.

(iii) The controller, where used, shall be so designed and installed that a single ground or short circuit will not prevent both the normal and final stopping device from stopping the working platform.

(iv) Means shall be provided on the roof car and

working platform for grounding portable electric tools.

(v) The working platform shall be grounded through a grounding connection in a traveling cable. Electrically powered tools utilized on the working platform shall be grounded.

(F) Electrical receptacles located on the roof or any other exterior location shall be of a weatherproof type and shall be located so as not to be subject to contact with water or accumulated snow. The receptacles shall be grounded, and the electric cable shall include a grounding conductor. The receptacle and plug shall be a type designed to avoid hazard to persons inserting or withdrawing the plug. Provision shall be made to prevent application of cable strain directly to the plug and receptacle.

(G) Electric runway conductor systems shall be a type designed for use in exterior locations and shall be located so as not to be subject to contact with water or accumulated snow. The conductors, collectors, and disconnecting means shall conform to the same requirements as those for cranes and hoists in article 610 of NFPA 70. A grounded conductor shall parallel the power conductors and be so connected that it cannot be opened by the disconnecting means. The system shall be designed to avoid hazard to persons in the area.

(H) Electrical protective devices and interlocks of the weatherproof type shall be provided.

(I) Where the installation includes a roof car, an electric contact shall be provided and so connected that the operating devices for the working platform shall be operative only when the roof car is located and mechanically retained at an established operating point.

(J) Where the powered platform includes a power-operated roof car, the operating device for the roof car shall be inoperative when the roof car is mechanically retained at an established operating point.

(K) An electric contact shall be provided and so connected that it will cause the down direction relay for vertical travel to open if the tension in the traveling cable exceeds safe limits.

(L) An automatic overload device shall be provided to cut off the electrical power to the circuit in all hoisting motors for travel in the up direction, should the load applied to the hoisting ropes at

either end of the working platform exceed 125 per cent of its normal tension with rated load, as shown on the manufacturer's data plate on the working platform.

(M) An automatic device shall be provided for each hoisting rope which will cut off the electrical power to the hoisting motor in the down direction and apply the brakes if any hoisting rope becomes slack.

(N) Upper and lower directional limit devices shall be provided to prevent the travel of the working platform beyond the normal upper and lower limits of travel.

(O) Operation of a directional limit device shall prevent further motion in the appropriate direction, if the normal limit of travel has been reached.

(P) Directional limit devices, if driven from the hoisting machine by chains, tapes, or cables, shall incorporate a device to disconnect the electric power from the hoisting machine and apply both the primary and secondary brakes in the event of failure of the driving means.

(Q) Final terminal stopping devices of the working platform.

(i) Final terminal stopping devices for the working platform shall be provided as a secondary means of preventing the working platform from overtraveling at the terminals.

(ii) The device shall be set to function as close to each terminal landing as practical, but in such a way that under normal operating conditions it will not function when the working platform is stopped by the normal terminal stopping device.

(iii) Operation of the final terminal stopping device shall open the potential relay for vertical travel, thereby disconnecting the electric power from the hoisting machine, and applying both the primary and secondary brakes.

(iv) The final terminal stopping device for the upper limit of travel shall be mounted so that it is operated directly by the motion of the working platform itself.

(R) Emergency stop switches shall be provided in or adjacent to each operating device.

(S) Emergency stop switches shall:

(i) Have red operating buttons or handles;

(ii) Be conspicuously and permanently marked, "stop;"

(iii) Be the manually opened and manually closed type; and

(iv) Be positively opened with the opening not solely dependent on springs.

(T) The manual operation of an emergency stop switch associated with an operating device for the working platform shall open the potential relay for vertical travel, thereby disconnecting the electric power from the hoisting machine and applying both the primary and secondary brakes.

(U) The manual operation of the emergency stop switch associated with the operating device for a power-driven roof car shall cause the electrical power to the traverse machine to be interrupted, and the traverse machine brake to apply.

(22) Requirements for emergency communications.

(A) Communication equipment shall be provided for each powered platform for use in an emergency.

(B) Two-way communication shall be established between personnel on the roof and personnel on the stalled working platform before any emergency operation of the working platform is undertaken by personnel on the roof.

(C) The equipment shall permit two-way voice communication between the working platform and:

(i) Designated personnel continuously available while the powered platform is in use; and

(ii) Designated personnel on roof-powered platforms, undertaking emergency operation of the working platform by means of the emergency operating device located near the hoisting machine.

(D) The emergency communication equipment shall be one of the following types:

(i) The equipment shall be a telephone connected to the central telephone exchange system; or

(ii) The equipment shall be telephones on a limited system or an approved two-way radio system, provided designated personnel are available to receive a message during the time the powered platform is in use.

(c) Type T powered platforms.

(1) The roof car requirements of subsection (b)(1) through (5) shall apply to type T powered platforms.

(2) The working platform requirements subsection (b)(6) through (16) apply to type T powered platforms.

(A) The working platform shall be suspended by at least 2 wire ropes.

(B) The maximum rated speed at which the working platform of self-powered platforms may be moved in a vertical direction shall not exceed 35 feet per minute.

(3) The hoisting equipment requirements of subsection (b)(17) and (18) shall apply to type T powered platforms.

(4) Brake requirements of subsection (b)(19) shall apply to type T powered platforms.

(5) Hoisting ropes and rope connections.

(A) Subsection (b)(20)(A) through (E) and (G) shall apply to type T powered platforms.

(B) Adjustable shackle rods in subsection (b)(20)(F) shall apply to type T powered platforms if the working platform is suspended by more than 2 wire ropes.

(6) Electrical wiring and equipment.

(A) The requirements of subsection (b)(21)(A) through (F) shall apply to type T powered platforms. Electrical wiring and equipment shall comply with the specifications contained in part II, section 26, of ANSI A120.1.

(B) For electrical protective devices, the requirements of subsection (b)(21)(A) through (H) and the specifications contained in part II, section 26, of ANSI A120.1 shall apply.

(7) All the requirements of subsection (b)(22) shall apply to type T powered platforms.

(8) Safety belts and lifelines.

(A) Each employee on the working platform of type T powered platforms shall be provided with a safety belt with means for attachment to a lifeline on the roof or to the working platform. It is recommended that safety belts, lines, and other components, including fastening means and anchorages to the working platform, building, or structure, be capable of withstanding a static load of 4,000 pounds without damage or permanent deformation of any part.

(B) Harness-type belts are recommended. If body-type belts are used, it is recommended that the portion of the belt bearing on the front of the wearer's body have a minimum width of 3 inches.

(C) It is recommended that the line used to connect the belt to the platform, or to a lifeline attached to the building, have a maximum length of 5 feet.

(d) Inspections and tests.

(1) All powered platform installations shall, on their completion, and before being placed in service, be subjected to an acceptance test in the field to determine

that all parts of the installation conform to applicable requirements of this appendix, and all safety and operating equipment functions as required. A similar inspection and test shall be made following a major alteration to an existing installation.

(2) Each installation shall undergo a periodic inspection and test at least every 12 months. All parts of the equipment shall be inspected, and where necessary, tested to determine that they are in safe operating condition.

(3) Each installation shall undergo a maintenance inspection and test every 30 days, except where the cleaning cycle is less than 30 days, the inspection and test shall be made prior to each cleaning cycle. The results of these inspections and tests shall be certified (in writing), and provided upon request to the director. Each entry shall include the date of the inspection or test and shall be signed by the person making the inspection or test.

(4) Special inspection of governors and secondary brakes.

(A) Special inspections and tests of the governor and secondary braking system shall be made at intervals not exceeding 1 year.

(B) The inspection and test shall include a verification that the initiating device for the secondary braking operates at the proper overspeed.

(C) If adequate tests cannot be performed in the field, the initiating device may be removed from the powered platform and sent to a shop equipped to make the test.

(D) The inspection shall include a verification of the proper functioning of the secondary brake. If an adequate test cannot be performed in the field, the hoisting machine may be removed from the building and sent to a shop equipped to make the test.

(E) If any hoisting machine or initiating device for the secondary brake system is removed from the building for testing, all reinstalled and directly related components shall be reinspected prior to returning the powered platform installation to service.

(5) Powered platforms shall not be operated during severe adverse weather conditions.

(6) Maintenance.

(A) All parts of equipment on which safe operation depends shall be maintained in proper working order so that they perform the function for which they are intended.

(B) Broken or worn parts, worn switch contacts, brushes, and short flexible conductors of electrical devices,

which may interfere with safe operation, shall be replaced promptly. Electrical receptacles and plugs shall be replaced promptly when worn or damaged. All electrical connections shall be kept tight.

(C) Components of the electrical service system and traveling cables shall be replaced when damaged or substantially abraded.

(D) Gears, shafts, bearings, brakes, and hoisting drums shall be maintained in proper alignment. Gears shall be replaced promptly when there is evidence of appreciable wear.

(7) Cleaning.

(A) Controller contactors and relays shall be kept clean and free from dirt.

(B) All other parts shall be kept clean, if their proper functioning would be affected by the presence of dirt or other contaminants.

(8) The ropes shall be reshackled at the non-drum ends at intervals not exceeding 24 months. In reshackling the ropes, a sufficient length shall be cut from the end of the rope to remove damaged or fatigued portions.

(9) No person shall at any time make any required safety device or electrical protective device inoperative, except when necessary during tests, inspections, and maintenance. Immediately upon completion of the test, inspection, and maintenance, the devices shall be restored to their normal operating condition.

(10) Wire ropes shall be replaced whenever there are 6 or more broken wires in any 1 lay of the wire rope, or whenever the ropes are damaged or in a deteriorated condition.

(11) Roof track systems or tiedowns, or similar equipment, if provided, shall be maintained in proper working order so that they perform the function for which they are intended.

(12) T-rails or indented mullions, or equivalent guides located in the face of the building, if provided, shall be maintained in proper working order so that they perform the function for which they are intended. Brackets for cable stabilizers, if provided, shall similarly be maintained in proper working order. [Eff. 12/6/82; am 8/16/84; am 8/15/87; am and comp 3/22/91] (Auth: HRS §396-4) (Imp: HRS §396-4)

§12-83-3 Vehicle-mounted elevating and rotating work platforms. **(a)** This section applies to these types, or to any combination of these types, of vehicle-mounted aerial devices used to elevate personnel to job sites above ground:

(1) Extensible boom platforms;
(2) Aerial ladders;
(3) Articulating boom platforms; and
(4) Vertical towers.

These devices are made of metal, wood, or fiberglass reinforced plastic (FRP), or other material, and are powered or manually operated, whether or not they are capable of rotating about a substantially vertical axis. The requirements of this section do not include any matter relating to firefighting equipment or to any matter relating to the vehicles upon which aerial devices are mounted, except in respect to a vehicle being a stable support for the aerial device.

(b) All new vehicle-mounted elevating and rotating work platforms after the effective date of chapter 12-83 shall meet the design, construction, and test specifications of ANSI A92.2.

(c) Electrical clearances.

(1) When operating aerial devices proximate to, under, over, by or near electric power lines, the requirements of this subsection shall apply. The owner, agent, or employer responsible for operation of the equipment shall post and maintain in plain view of the operator on each aerial device, a durable warning sign legible at 12 feet reading, "Unlawful to Operate This Equipment Within Ten Feet of High-Voltage Lines," and, also, a sign with letters of similar size reading, "This Equipment Shall be Positioned, Equipped, or Protected So That No Part Shall be Capable of Coming Within Ten Feet of High-Voltage Lines." The following clearances shall be maintained.
    (A) For lines rated at 50kV or less, the minimum clearance between the lines and any part of the aerial device shall be at least 10 feet.
    (B) When the lines are rated in excess of 50kV, the minimum clearance between the lines and any part of the aerial device shall be at least 10 feet plus 0.4 inch for each kilovolt in excess of 50kV, or twice the length of the line insulator, but never less than 10 feet.
(2) Paragraph (1) above does not apply:
    (A) Where the work is performed from an aerial device insulated for the work, and the work is performed by either telecommunications employees, line-clearance tree-trimming employees, or electric utility employees; or
    (B) Where the electric power transmission or distribution lines have been deenergized and visibly grounded at the point of work, or where insulating barriers, not a part of or an attachment to the aerial device, have

been erected to prevent physical contact with the lines.

(3) Proximity warning devices may be used, but not in lieu of meeting the requirements contained in paragraph (1) above.

(4) The owner of the lines or the owner's authorized representative shall be notified and provided with all pertinent information before the commencement of operations near electrical lines.

(5) Any overhead wire shall be considered to be an energized line until the owner of the line or the owner's authorized representative states that it is deenergized.

(d) Specific Requirements.

(1) Before a ladder or tower truck is moved for highway travel, aerial ladders shall be secured in the lower traveling position by the locking device above the truck cab, and the manually operated device at the base of the ladder, or by other equally effective means (e.g., cradles which prevent rotation of the ladder in combination with positive acting linear actuators).

(2) Extensible and articulating boom platforms.

(A) Lift controls shall be tested each day prior to use to determine that these controls are in safe working condition.

(B) Only trained persons shall operate an aerial lift.

(C) Employees shall not belt off to an adjacent pole, structure, or equipment while working from an aerial lift.

(D) Employees shall always stand firmly on the floor of the basket, and shall not sit or climb on the edge of the basket or use planks or ladders, or other devices, for a work position.

(E) A body belt shall be worn and a lanyard attached to the boom or basket when working from an aerial lift.

(F) Boom and basket load limits specified by the manufacturer shall not be exceeded.

(G) The brakes shall be set and outriggers, when used, shall be positioned on pads or a solid surface. Wheel chocks shall be installed before using an aerial lift on an incline.

(H) An aerial lift truck may not be moved when the boom is elevated in a working position with workers in the basket, except for equipment which is specifically designed for this type of operation.

(I) Articulating boom and extensible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within

easy reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

(J) Climbers shall not be worn while performing work from an aerial lift.

(K) The insulated portion of an aerial lift shall not be altered in any manner that might reduce its insulating value.

(L) Before moving an aerial lift for travel, the boom shall be inspected to see that it is properly cradled and outriggers are in stowed position, except as provided in subparagraph (H) above.

(3) Electrical tests shall be made in conformance with the requirements of ANSI A92.2, section 5. However, equivalent dc voltage tests may be used in lieu of the ac voltage test specified in ANSI A92.2; dc voltage tests which are approved by the equipment manufacturer or equivalent entity shall be considered an equivalent test.

(4) All critical hydraulic and pneumatic components shall comply with ANSI A92.2, section 4.9. Critical components are those in which a failure would result in a free fall or free rotation of the boom. All noncritical components shall have a bursting safety factor of at least two to one. [Eff. 12/6/82; am 8/16/84; am and comp 3/22/91] (Auth: HRS §396-4) (Imp: HRS §396-4)

§12-83-4 <u>Powered platforms for wind turbines</u>. (a) This section establishes safety requirements for the design, construction, installation, operation, maintenance, inspection, and use of powered platforms which are installed permanently within towers that support wind turbines and which are used exclusively for maintenance of the wind turbine. This section applies only to electric-powered platforms. A variance from the power requirements of this section is required in accordance with chapter 12-53 for other types of power.

(b) Overhead beams.

(1) The overhead beams shall be designed to support the weight of all apparatus resting on the beams, plus twice the maximum weight suspended from the beams.

(2) The overhead beams and their supports shall be steel and their factor of safety shall be not less than 5.

(3) The allowable deflections of overhead beams and their immediate supports under static load shall not exceed 1/1666 of the span.

(c) Suspension.

(1) The platform shall be suspended by one or more wire ropes.
(2) Wire ropes suspending the platform shall:
(A) Be either 6 x 19 or 6 x 37 classification, preformed or nonpreformed;
(B) Have a minimum safety factor of 10, which shall be calculated by:

$$F = \frac{S \times N}{W}$$

where:

F = Safety factor,
S = Manufacturer's rated breaking strength of one rope,
N = Number of ropes under load, and
W = Maximum static load on all ropes with the platform and its rated load at any point of its travel;

(C) Be sized to provide at least the minimum safety factor but shall not be less than 5/16-inch diameter;
(D) Be neither lengthened nor repaired by joining lengths of wire rope; and
(E) Have no more than two reverse bends in each rope.
(3) A metal data tag shall be securely attached to one of the wire-rope fastenings. The data tag shall contain this data:
(A) Wire-rope diameter in inches;
(B) The manufacturer's rated breaking strength;
(C) The grade of material used;
(D) The month and year that the wire ropes were installed;
(E) Whether non-preformed or preformed;
(F) Construction classification;
(G) The name of the person or firm by whom the wire ropes were installed; and
(H) The name of the manufacturer of the wire ropes.
(4) The wire-rope data tag shall be made and lettered in the same manner as the load-rating plate as described in subsection (d)(5).
(5) A new data tag, conforming to paragraphs (3) and (4) above shall be installed at each wire-rope renewal.
(d) Platform.
(1) The platform shall have wire-rope guides attached to the highest and lowest point on each side. The guides shall have non-abrasive liners. A wire rope shall pass through the wire-rope guides on each side of the platform in order to stabilize the platform. The wire ropes used for

stabilization shall meet the requirements of subsection (c)(2) above and shall have one end fastened to an overhead beam and the other end fastened to the tower base.

(2) A wire rope, separate from the wire ropes used for stabilization, shall be installed to serve as a lifeline for the platform. The wire rope used as a lifeline shall meet the requirements of subsection (c)(2) above and shall have one end fastened to an overhead beam and the other end fastened to the tower base.

(3) A wire-rope-grab device shall be attached to the wire rope used as a lifeline. The device shall:
   (A) Be capable of supporting the platform and its load;
   (B) Be guarded so that it cannot be inadvertently activated or released; and
   (C) If for any reason the platform accelerates downward in excess of the maximum rated speed, stop the platform when the platform is loaded at any weight up to 125 per cent of its rated capacity.

(4) The platform shall be of girder or truss construction and shall be adequate to support its rated load under any condition of asymmetrical loading.

(5) The platform shall bear a manufacturer's load-rating plate, conspicuously posted, displaying the maximum load. The plate shall be made of non-corrosive material. It shall have letters and figures stamped, etched, or cast on the surface; the minimum height of the letters and figures shall be 1/4 inch.

(6) The platform shall have:
   (A) A minimum width of 24 inches;
   (B) A guardrail not less than 42 inches in height;
   (C) An intermediate guardrail around the entire platform between the top guardrail and the toeboard; and
   (D) A 4-inch toeboard around the entire platform.

(7) The platform flooring shall be solid and have a non-skid surface.

(8) A landing frame on the lower level shall be installed to hold the platform steady for persons entering and exiting the platform.

(9) No more than four persons shall occupy the platform at once.

(10) A legible sign shall be conspicuously posted on the platform that displays this message or an equivalent message: "Safety Belts Shall Be Worn While Using This Platform. Safety-belt Lanyards Shall Be Attached To This Platform."

(11) Effective means, such as signs, shall be used to define

the danger zone beneath the platform at the tower base when the platform is in operation.

(12) All tools and equipment shall be in a container while being transported on the platform.

(13) Upper and lower normal-terminal-stopping devices shall be installed to stop the platform at or near the top and bottom terminal landings with any load up to and including the rated load on the platform and from any speed attained in normal operation. These devices shall function independently of the normal stopping means and of the final-terminal-stopping device. Stopping switches shall be located on the platform or the hoist structure and shall be operated by the movement of the platform. The normal-terminal-stopping device may be used as the normal-stopping means.

(14) Final-terminal-stopping devices shall be installed and arranged to cause the electric power to be removed automatically from the hoist-driving-machine motor and brake after the platform has passed a terminal landing. The device shall be set so it will function as close to the terminal landing as practicable but, under normal operating conditions, will not function when the platform is stopped by the normal-terminal-stopping device. The operation of final-terminal-stopping devices shall not prevent movement of the platform by the normal operating devices in both directions of travel. These devices shall be reset manually.

(15) The platform shall have rollers mounted on its outside perimeter to eliminate the possibility of the platform dragging on the inner wall of the tower.

(16) Solid bumpers shall be installed under the platform.

(A) The bumpers shall be located so as to retard the platform without exceeding its allowable design stresses.

(B) The bumpers shall be made of suitably resilient material, such as wood, that is able to withstand without failure the impact of the platform at rated load descending at maximum rated speed.

(e) Hoisting.

(1) A power-driven drum or drums shall be used for hoisting. These winding drums and any overhead or deflecting sheaves shall have a pitch diameter of not less than 30 times the diameter of the wire ropes suspending the platform. Friction devices or clutches shall not be used for connecting the main driving mechanism to the drum or drums. Belt-driven or chain-driven mechanisms shall not be used.

(2) Hoisting motors shall be weatherproof and conform to NFPA 70, except as modified by ANSI A120.1.
(3) The maximum rated speed at which the platform may be moved in either direction shall not exceed 35 feet per minute.
(4) The hoisting machine shall have two independent braking means, each designed to stop and hold the working platform with 125 per cent of rated load.
(5) Winding drums shall have at least three turns of rope remaining when the platform has landed at the lowest possible point of its travel.
(6) The non-drum ends of the hoisting ropes shall be provided with individual adjustment of wire-rope lengths. The wire-rope fastening shall have at least 80 per cent of the ultimate breaking strength of the wire rope. The wire-rope fastenings shall be zinc-coated or galvanized, drop-forged fist grips (or equivalent) and wire-rope thimbles, or approved special fastening devices. When fist grips are used, the minimum number, spacing, and tightening torque shall be in accordance with the instructions of the grip manufacturer. Grips shall be periodically checked and retightened to the recommended torque. Babbitted rope sockets shall not be used.
(7) An out-of-level safety device shall be installed that shall stop the hoist motors if the platform tilts, or a slack-rope device shall be installed which shall be equipped with a slack-rope switch of the enclosed, manually reset type which shall cause the electric power to be removed from the hoisting mechanism and brake if one or more of the hoisting ropes become slack.
(8) An overload safety device shall be installed that shall stop the hoist motors if an attempt is made to carry a load that exceeds the platform's rated capacity.
(9) Platforms having a polyphase alternating current power supply shall have means installed to prevent the starting of the hoist motor if the phase rotation is in the wrong direction, or if there is a failure of any phase.

(f) Electrical wiring and equipment.

(1) All electrical equipment and wiring shall conform to NFPA 70, except as modified by ANSI A120.1.
(2) All motors, and operation or control equipment, shall be supplied from a single power source.
(3) The power supplied for the platform shall be through an independent circuit with a fused disconnect switch or circuit breaker.
(4) The controller shall be designed and installed so that a single ground or short circuit will not prevent the normal-terminal-stopping device from stopping the

platform.

(5) Means shall be provided on the platform for grounding portable electric tools.

(6) Electrically powered tools used on the platform shall be grounded or double insulated.

(7) The platform shall be grounded through a grounding connection in the traveling cable.

(g) Operating devices.

(1) The operating devices for the platform shall be located on the platform and shall be continuous-pressure, weatherproof electric types.

(2) The operating devices shall be operable only when all electrical protective devices and interlocks on the platform are in position for normal service.

(3) The operating devices shall be clearly marked to identify which hoist motor each controls.

(h) Safety belts and lifelines.

(1) Each employee on the platform shall be provided with a safety belt and lanyard meeting the requirements of section 12-64-10.

(2) Each employee on the platform shall attach the safety-belt lanyard to a substantial frame member of the platform.

(i) Inspections and tests.

(1) The powered-platform installation shall, on its completion, and before being placed in service, be subjected to an acceptance test by the employer to determine that all parts of the installation conform to applicable requirements of this section, and all safety and operating equipment functions as required. A similar inspection and test shall be made following a major alteration to an existing installation.

(2) Each installation shall undergo a periodic inspection and test at least every 12 months. All parts of the equipment shall be inspected, and, where necessary, tested to determine that they are in safe operating condition.

(3) Each installation shall undergo a maintenance inspection and test every 30 days; however, where the cleaning cycle is less than 30 days, the inspection and test shall be made prior to each cleaning cycle. The results of these inspections and tests shall be recorded in a log which shall be available for review by the director of the department of labor and industrial relations or the director's representative. Each log entry shall include the date of the inspection or test and shall be signed by the person making the inspection or test.

(4) Special inspection of governors and secondary brakes. (A) Special inspections and tests of the governor and

secondary braking system shall be made at intervals not exceeding one year.

(B) The inspection and test shall include a verification that the initiating device for the secondary braking operates at the proper overspeed.

(C) If adequate tests cannot be performed in the tower, the initiating device may be removed from the powered platform and sent to a shop equipped to make the test.

(D) The inspection shall include a verification of the proper functioning of the secondary brake. If an adequate test cannot be performed in the tower, the hoisting machine may be removed from the tower and sent to a shop equipped to make the test.

(E) If any hoisting machine or initiating device for the secondary brake system is removed from the tower for testing, all reinstalled and directly related components shall be reinspected prior to returning the powered-platform installation to service.

(5) Maintenance.

(A) All parts of equipment which contribute to safe operation shall be maintained in proper working order so that they perform the function for which they are intended.

(B) Broken or worn parts, worn switch contacts, brushes, and short flexible conductors of electrical devices, which may interfere with safe operation, shall be replaced promptly. Electrical receptacles and plugs shall be replaced promptly when worn or damaged. All electrical connections shall be replaced promptly when worn or damaged. All electrical connections shall be kept tight.

(C) Components of the electrical service system and traveling cables shall be replaced when damaged or substantially abraded.

(D) Gears, shafts, bearings, brakes, and winding drums shall be maintained in proper alignment. Gears shall be replaced promptly when there is evidence of appreciable wear.

(6) Cleaning.

(A) Controller contactors and relays shall be kept clean and free from contaminants such as dirt, dust, oxidation, and carbon.

(B) All other parts shall be kept clean, if their proper functioning would be affected by the presence of contaminants.

(7) The ropes shall be reshackled at the non-drum ends at

intervals not exceeding 24 months. In reshackling the ropes, a sufficient length shall be cut from the end of the rope to remove damaged or fatigued portions.

(8) No person shall at any time make any required safety device or electrical protective device inoperative, except when necessary during tests, inspections, and maintenance. Immediately upon completion of the test, inspection, and maintenance, the devices shall be restored to their normal operating condition.

(9) Wire ropes shall be replaced whenever there are 6 or more broken wires in any one lay of the wire rope, or whenever the ropes are damaged or in a deteriorated condition. When it is necessary to replace one hoisting rope, the entire set of hoisting ropes shall be replaced.

[Eff. 2/4/85; am and Ren §12-83-4 and comp 3/22/91] (Auth: HRS §396-4) (Imp: HRS §396-4)